73 AMATEUR RADIO

International Edition

OCTOBER 1988
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A WGE Publication

Everyham's Microwave Issue

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Microwave Ham Band Overview

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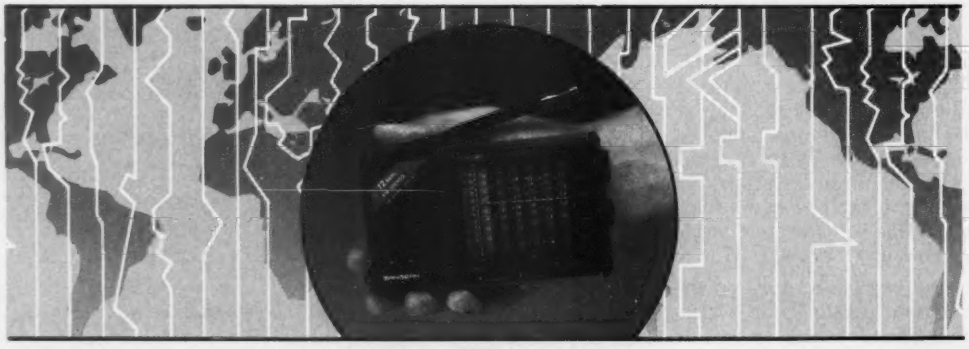

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. . . *plus* you get a ***peak* reading** Cross-Needle SWR/Wattmeter, 6-position antenna switch, balun for balanced lines and 1.8-30 MHz coverage...$239.95

MFJ-986

$239.95

MFJ's innovative new Differential-T Tuner™ uses a differential capacitor that makes tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only *one* setting.

The new MFJ-986 is a rugged no-compromise 3 KW PEP Roller Inductor antenna tuner that covers 1.8-30 MHz continuously, including MARS and all the WARC bands. **The roller inductor lets you tune your SWR down to the absolute minimum** -- something a tapped inductor tuner just can't do.

A 3-digit turns counter plus a spinner knob gives you *precise* inductance control -- so you can quickly return to your favorite frequency.

You get a lighted Cross-Needle meter that not only gives you SWR, forward and reflected power at a glance -- but also gives you a **peak-reading** function! A new directional coupler gives you even more accurate readings over a wider frequency range.

You get a 6-position ceramic antenna switch that lets you select two coax lines and/or random wires (direct or through tuner), balanced line and external dummy load.

A new **current** balun for balanced lines minimizes feedline radiation that causes field pattern distortion, TVI and RF in your shack. Ceramic feedthru insulators for balanced lines withstand high voltages and temperatures.

New Antenna Tuner Technology

MFJ brings you **three innovations** in antenna tuner technology: a new *Differential-T™* circuit simplifies tuning; a new *directional coupler* gives you more accurate SWR, forward and reflected power readings; and a new *current balun* reduces feedline radiation.

Differential-T Tuner™: A New Twist on a Proven Technology

By replacing the two variable capacitors with a single *differential capacitor* **you get a wide range T-network tuner with only *two* controls** -- the differential capacitor and a roller inductor.

That's how you get the new MFJ Differential-T Tuner™ that makes tuning easier than ever, gives you minimum SWR at only one setting and has a broadband response that ends constant re-tuning. You'll spend your time QSOing instead of fooling with your tuner.

The compact 10¾ x 4½ x 15 inch cabinet has plenty of room to mount the silver-plated roller inductor away from metal surfaces for maximum Q -- you get high efficiency and more power into your antenna.

The wide spaced air gap differential transmitting capacitor lets you run a full 3 KW PEP -- no worries about arcing.

A New Directional Coupler: Accurate SWR and Power Reading

MFJ's Cross-Needle SWR/Wattmeter gives you more accurate SWR and power readings over a wider frequency range with no frequency sensitive adjustments.

That's because MFJ's new directional coupler gives you up to an order of magnitude higher directivity and coupling factor than conventional circuits . . . *plus* it gives you a flat frequency response that requires **no** frequency compensation.

The cross-needle meter lets you read forward/reflected power in 2 ranges: 200/50 and 2000/500 watts. The meter lamp is front-panel switched and requires 12 volts.

A switch lets you select peak or average power readings.

A New Current Balun: Reduces Feedline Radiation

Nearly all commercially built tuners use a "voltage" balun. The "voltage" balun forces the *voltages* to be equal on the two antenna halves. It minimizes unbalanced currents *only* if the antenna is perfectly balanced --not the case with practical antennas.

The MFJ-986 uses a true **current balun** to force equal *currents* into the two antenna halves -- *even* if your antenna is not perfectly balanced -- so you get minimum unbalanced currents.

The *current* balun gives superior balance over the "voltage" balun.

Minimum unbalanced current reduces field pattern distortion -- which concentrates your power for a stronger signal -- *plus* it reduces TVI and RF in your shack caused by feedline radiation.

The MFJ-986 Differential-T Tuner™: Get *absolute minimum* SWR

Get the tuner that incorporates the latest innovations by the world's leader in antenna tuner technology.

See your dealer today for the new MFJ-986 Differential-T™ 3 KW Roller Inductor Tuner. Include $10 shipping/handling if ordering direct.

WHY CHOOSE AN MFJ TUNER?

Hard-earned Reputation: There's just no shortcut. *MFJ is a name you can trust* -- more hams trust MFJ tuners throughout the world than all other tuners combined.

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CIRCLE 24 ON READER SERVICE CARD

Welcome, Newcomers!

What's "Hot" About Microwaves

Microwaves first awed us (and made some of us very suspicious) with their ability to brew up a piping hot cup of coffee in 30 seconds, or cook a meal in 3 minutes. Now, we hear more about communications associated with microwaves. Telephone companies routinely use microwave relays, and many television studios transfer their programming to the broadcast site via microwave links. The proliferation of satellite dishes in residential back yards and on homes attest to the immense popularity of satellite TV, in which signals on the microwave bands are **uplinked** to, and **downlinked** from, satellites orbiting the equator.

Do the same waves both cook and carry communications?—most certainly! Furthermore, microwaves are part of the **electromagnetic wave spectrum**, which contains waves of immensely varying properties, such as X-rays, ultraviolet light, visible light, infra-red, and those that carry AM and FM broadcast signals, among others. The form of these waves, however, are exactly the same—they differ only in **frequency**.

More and more **hams** are taking an interest in microwave operation. Why this is just a recent phenomenon, and their vast potential, is the thrust of this month's column.

Long Known About

It's a little known fact that microwave communications has existed since the very early days of radio investigation. Guglielmo Marconi, the father of wireless radio, made his first major contribution to communications technology in 1897 by sending a microwave signal that was received several miles distant.[1] As early as 1933, a commercial microwave link was set up across the English channel, which operated for many years.

Why haven't hams, however, really ventured into these bands until recently? For a combination of reasons:

- Line-of-sight **propagation**. Except during highly unusual weather conditions, microwaves travel in a straight line. Waves of much lower frequencies, generally those below 30 **MHz**, usually travel to the ionosphere, which refracts them back to Earth to points many miles away.
- Specialized components. Only very precise (and expensive) components could cleanly generate such high frequencies.
- High **attenuation**. Microwave energy is much more absorbed by organic matter than waves of lower frequencies. Even moisture greatly absorbs microwave energy at certain frequencies in the higher end of the microwave subspectrum. It's this property that makes microwaves ideal for cooking!

Much has changed, however. Commercial interests have been developing microwave communication systems in earnest in the past 20 years, which has increased the supply, and driven down the cost, of microwave components. **Transponder**-equipped satellites for many communication services, including amateur radio, now orbit the Earth. They greatly increase the range of line-of-sight signals, and reduce the attenuation problem, since these signals do not encounter trees, mountains, and other energy-absorbing obstacles on their way to and from the satellite.

And what do these bands have in their favor? First and foremost is the vast amount of bandspace there is in the microwave region—one ham band alone contains almost as much bandspace as all the ham bands below it combined![2] This permits much **wideband** operation, which is desirable since, the wider the signal, the more quickly it can convey information. There are many **modes** of operation, too, that hams can investigate in the microwave regions, which can't be in the lower frequency regions due to the relatively narrow band allocations there. A secondary reason is that microwave antennas do not need to be as large as those needed for lower frequency signals, for comparable **gain**. These antennas, too, are easily made to be extremely directive, which helps reduce unnecessary interference.

Microwaves offer a unique opportunity for hams to explore new techniques and operation methods—and more cheaply than ever before. Come and explore this frontier! 73 de NS1B

[1] Marconi's best-known contribution to radio communications is the first transoceanic wireless transmission. In December 1901, Marconi sent the letter "S" from a site near St. John's Newfoundland, which was received in Poldhu, Cornwall.

[2] The 3 cm (10–10.500 GHz) band is 500 MHz wide. All the amateur bands below 3 cm to 160 meters total up to less than 510 MHz of bandspace.

GLOSSARY

Attenuation—Dampening, reduction.

Band—A group of frequencies.

Downlink—A signal that is sent from a satellite to an Earth-based station.

Electromagnetic wave spectrum—This represents the entire range of frequencies or wavelengths of electromagnetic energy. Radio waves typically range from 20,000 cycles/second to 300,000 million cycles/second. The microwave portion of the spectrum is typically set at 1,000–300,000 cycles/second.

Frequency—One of the two terms that characterizes electromagnetic waves. It is the number of cycles of a wave that passes a given point in a given period of time. (A wave cycle is the portion of the wave from one peak to the next.) The frequency is usually given in meters per second, commonly termed Hertz (Hz).

Gain—Describes the increase of voltage, current, or power. Gain is a ratio. A given transmitting antenna's gain, for example, is the strength of its radiated signals compared to the strength of the radiated signals of a reference antenna. Gain is usually represented in logarithmic units called **decibels** (dB).

Ham—Short for amateur radio operator.

MHz—Abbreviation for megahertz. This stands for "millions of cycles per second."

Mode—Mode has several meanings. In this case, it refers to the way information is imposed on a radio wave. AM and FM are two modes.

Propagation—This refers to the travelling of radio waves through a given medium, such as the atmosphere. The better the propagation, the further this energy travels through the medium.

Transponder—The unit on a satellite that receives a signal from Earth and simultaneously retransmits it back to Earth, on a frequency distant from the receive frequency.

Uplink—A signal that is sent from an Earth-based station to a communications satellite.

Wavelength—One of the two principal characterizations of an electromagnetic wave. The wavelength is conventionally measured from one wave peak to the next. This distance is usually given in meters or centimeters.

Wideband—Refers to a signal that occupies a relatively broad piece of spectrum. An AM broadcast signal, for example, takes up 6,000–8,000 cycles of bandspace, and so is not considered very wideband. The signal that carries the combined audio and color video to your TV set, however, occupies 6 *million* cycles of bandspace, making it wideband.

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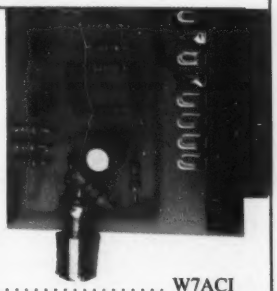

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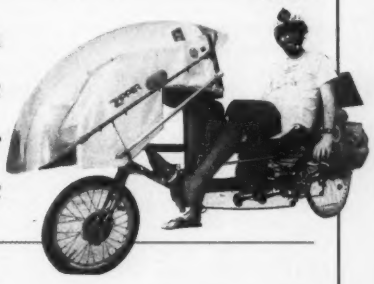

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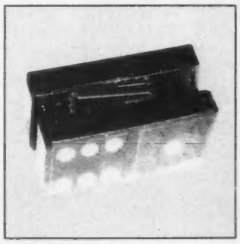

Cover model Jim Bail, *73* Ad Sales Representative and son of John Bail W8GFV who is Director, Receiver Division at American Electronic Laboratories. W8GFV directs microwave R and D for Military, Commercial, and Government applications. Jim is currently studying for his Novice ticket.
Photography by Suzanne Torsheya
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Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
WGE Center
Peterborough NH 03458-1194
phone: 800-225-5083

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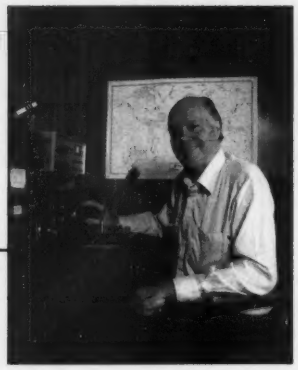
NEVER SAY DIE

Wayne Green W2NSD/1



Ham Fun

If we're going to kick-start ham radio we're going to have to put more fun into it—particularly for the kids. One easy way is to get our clubs going again with hidden transmitter hunts.

Since this is virtually a lost art in America, we'll be starting a column on fox hunting in November. I hope we'll be able to build enthusiasm for the European style of fox hunting—mostly done on foot instead of driving around in cars. This is better geared to getting youngsters into action. The exercise will be good for you old duffers too. Work off some of that paunch.

The column will be written by Joe Moell K0OV, who co-authored the book, "Transmitter Hunting: Radio Direction Finding Simplified," the RDFer's bible.

Meanwhile, I'll be looking for articles from you on hiding transmitters, building miniature transmitters to hide, designing and building hand-held direction-finding antennas, and building small DF receivers. Don't let me down on this.

Of course there are practical RDF applications such as finding unidentified repeater pests and service net jammers, locating a stolen rig which suddenly appears on a repeater, finding TV cable leaks, finding line noise sources—things like that.

If we can make fox hunting as popular here as it is in Europe and Asia, we may eventually be able to field some teams for the international fox hunting contests in Europe.

Atlanta Was There—Where Were You?

A few years ago it looked as if the Atlanta hams might be able to give Dayton a run. It hasn't happened. It was going pretty well when Chaz Cone W4GKF was at the stick, building steam.

Two years ago they moved the hamfest into the World Convention Center, next to the Omni Hotel. Big place, but the parking is expensive and a long walk from the hamfest—too far to carry heavy ham gear, the hotel's expensive, and there are no nearby camping facilities. It's not easy to get stuff in and out of the indoor flea market.

The exhibits committee apparently gave so many booths to local club groups and non-ham exhibitors that they ran out of commercial ham equipment exhibit space. This limited the dealers and manufacturers exhibits to a pitiful few.

The talks were handled well, but were very sparsely attended. I only pulled about 25 or so for my two talks. They might have promoted them a bit better, but mostly it was the overall lack of attendance. The hamfest just wasn't supported by the local hams—much less those from neighboring states.

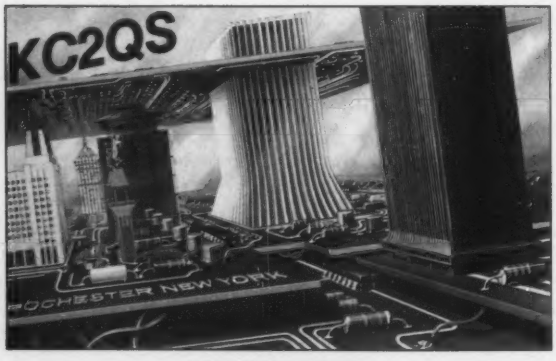
I missed the 1987 Hamfestival (I was visiting the USSR), but I was there for 1986 and it was very poorly attended. It was a bit better this year, but the hams from Georgia, Alabama and other nearby states were staying away by the thousands.

The few dealers who exhibited said their sales went well, with just about everything moving. Unlike 1986 and 1987, the few hams who did come brought money and spent it.

In the 70s, the Atlanta Hamfest was unique in that it regularly pulled bigger crowds on Sunday than Saturday. That's gone. Sunday was a wasteland, with many exhibitors pulling down their booths two or three hours before the show's official closing time.

As a known fooder, I was pleased to see a $5 buffet—rather good one, too. Plus they had free chow for the exhibitors, something guaranteed to put on a pound or two for me. Fortunately I got trapped at the *73* booth by a long-winded ham filling me in in-depth on his station equipment, so I missed the dessert—all gone by the time I got there!

Continued on page 90



QSL OF THE MONTH

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WGE Center
Peterborough, NH 03458-1194
603-525-4201
Subscription Customer Service
1-800-525-0643
Colorado/Foreign Subscribers
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TM-621A/721A

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- **Dual watch function allows VHF and UHF receive simultaneously.**
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- **Balance control and separate squelch controls for each band.**
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- **Frequency (dial) lock.**
- **Supplied accessories:** 16-key DTMF hand mic., mounting bracket, DC cable.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

TM-721A shown with optional RC-10.

Optional Accessories:
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TS-940S

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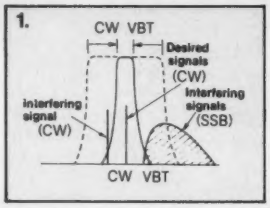
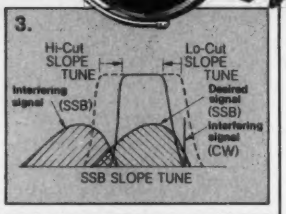
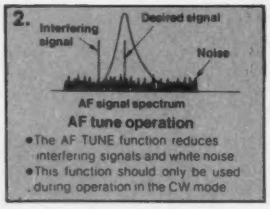
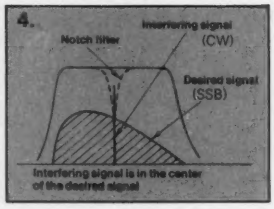
- **First with a full one-year limited warranty.**
- **Extremely stable phase locked loop (PLL) VFO.** Reference frequency accuracy is measured in ***parts per million!***






2.
Interfering signal
Desired signal
Noise
AF signal spectrum
AF tune operation
•The AF TUNE function reduces interfering signals and white noise.
•This function should only be used during operation in the CW mode.



1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

2) AF Tune. Enabled with the push of a button, this CW interference fighter inserts a tunable, three pole active filter between the SSB/CW demodulator and the audio amplifier. During CW QSOs, this control can be used to reduce interfering signals and noise, and peaks audio frequency response for optimum CW performance.

3) SSB Slope Tuning. Operating in the LSB and USB modes, this front panel control allows independent, continuously variable adjustment of the high or low frequency slopes of the IF passband. The LCD sub display illustrates the filtering position.

4) IF Notch Filter. The tunable notch filter sharply attenuates interfering signals by as much as 40 dB. As shown here, the interfering signal is reduced, while the desired signal remains unaffected. The notch filter works in all modes except FM.

- **Complete all band, all mode transceiver with general coverage receiver.** Receiver covers 150 kHz-30 MHz. All modes built-in: AM, FM, CW, FSK, LSB, USB.
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- **Simple one step mode changing with CW announcement.**
- **Other vital operating functions.** Selectable semi or full break-in CW (QSK), RIT/XIT, all mode squelch, RF attenuator, filter select switch, selectable AGC, CW variable pitch control, speech processor, and RF power output control, programmable band scan or 40 channel memory scan.

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL-922A linear amplifier • SM-220 station monitor • BS-8 pan display • SW-200A and SW-2000 SWR and power meters • IF-232C/IF-10B computer interface.

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Write On!

Want to earn some extra money and see your name in print, to boot? Due to the reader feedback we've been getting for the past year, *73 Magazine* will be running more reviews and light construction articles. To facilitate this shift, we need help from you, our faithful readership.

Builders generally don't try to write about what they build, mostly out of pen fright, but the plain fact is *anyone can write*. Ask for our writer's guidelines to see how easy it is. And don't worry if your prose isn't perfect—coherence is the main point. If your idea is good and reasonably explained, we will pay you top dollar for your piece.

How about an intriguing piece of ham gear on which you can't find a write-up anywhere? Perhaps *you* could be the first to tell the world about it! Send for our reviewer's form sheet.

73 Magazine is your forum. Don't keep your great ideas hidden in the shack—bring'em out for hamdom to read!

Joe Ham

Jack Speer N1BIC of Buckmaster, Inc. receives the monthly computer FCC data tapes of all licensed amateur radio operators. From the master file of all US licensed ham radio operators as of year end 1987, he determined the average age of US hams: 50 years.

Spread Spectrum

In an effort to pack more signals into a given piece of spectrum, engineers have traditionally looked for ways to minimize the bandwidth of radio signals. Imagine, however, a signal whose energy is *spread out* over a vast piece of spectrum—say, 500 MHz—so that the only effect it has on the ear is a slight raising of the noise floor. This is called *spread spectrum* (SS). Communications using this mode are possible when a transmitter and receiver follow identical FM schemes. Two SS signals occupying the same piece of spectrum, but using different modulation schemes, do not interfere with each other. Since the variety of possible waveforms and deviations (which compose a scheme) are nearly infinite, then it's possible to pack very many signals on the same piece of spectrum.

Many of you may be aware of the research going on with SS in the military and defense organizations, but few are aware that this is a legal mode for amateur radio! Those interested in finding out the latest in SS research for ham radio should contact the Amateur Radio Research and Development Corporation (AMRAD). Their address is PO Drawer 6148, McLean, VA 22106-6148.

You can also contact the AMRAD CBBS at (703) 734-1387. The system accepts 300, 1200, and 2400 baud, and the data path settings are 8 data bits, 1 stop bit, and no parity.

USSR Packet Radio?

On 28 June at 0324Z, Bill Slack NX2P worked UA3CR via packet radio on 14.105 MHz. Readers may recognize the Soviet call as none other than that of Leonid Labutin, whose interview appeared in the April issue under Ham Profiles. He is a foremost Soviet ham who coordinated communications for the Canada/USSR polar ski trek that took place earlier this year. Leo is also avidly interested in packet radio, but at the time of the interview indicated that packet radio was not then an accepted amateur mode in the USSR. This has apparently changed!

Packeteers who hear UA3CR and want to connect with him should bear in mind that Leo may have his transmit and received frequencies offset. Bill correctly guessed this after a half dozen retries, though signals were strong and the channel was clear. To effect the offset, simply move the frequency in small steps until you get a response to a connect request, and then adjust the RIT until you can decode the response.

Japan Ham News

Two bits of news from the Land of the Rising Sun:

—The JARL will soon begin work on another flight model of the JAS-1 with an eye toward launching a second amateur radio satellite, tentatively called JAS-1b.

—According to a report released by the Telecommunications Bureau of the Ministry of Posts and Telecommunications, as of 31 March 1988, they have issued a total of 1,608,128 amateur radio operator licenses. *The JARL News* did not indicate whether this figure represents all such licenses issued, or just current licenses.

More Able Cable

If the FCC has its way, you may get cable television delivered by the telephone company. The FCC says it may allow telephone companies to enter the cable television business in the same areas it allows phone service. The proposal may be just what's needed to get the telephone companies to install fiber optic wiring into residences, which currently costs a subscriber four times the amount over the installation of copper wiring. Fiber optic (lightwave) wiring of homes also allows phone companies to provide two-way services, pay per view TV, security, interactive video, and many other services not possible with copper wiring.

NIAC

Wayne Green W2NSD/1 has sent a letter to members of the amateur radio industry concerning the need for forming a National Industrial Advisory Committee (NIAC). The NIAC would act as a liaison between the amateur radio community and the FCC.

Green says that a previous NIAC was supported by the FCC, which provided a meeting room and support materials but "austerity programs finally doomed it." Wayne wants to revive it, saying: "We've let what was a hobby that provided virtually all the R & D for the communications industry *rot*. By allowing about 90% of the school radio clubs to die 25 years ago we've cut off the input of youngsters—the people who were doing most of the inventing and pioneering." He wants NIAC to research ways of attracting youngsters to ham radio . . . and to provide a voice with the FCC to help stave off a further loss of frequencies.

Wayne wants the NIAC to meet four times a year. The main annual meeting would take place in Washington DC, and the other three would take place at the three major hamfests—Orlando/winter, Dayton/spring, and Atlanta/summer. There would also be a monthly NIAC newsletter.

For more info on NIAC, contact Wayne at *73* HQ, at the address listed below.

Lithium Cell Warning

Do you realize that your (modern) HT may contain a miniature bomb? Lithium cells, used to maintain memory contents even when external power is removed, contain a volatile and toxic compound called thionyl chloride. Trying to force current back into these cells can result in a devastating explosion! Consider the case where a bus ticket dispensing machine was being repaired when the lithium battery's blocking diode failed. The resulting explosion injured five people who required hospital treatment for fume inhalation.

Big Thanks

. . . to the *AMRAD Newsletter*, *JARL News*, the *ARRL Gateway*, *CQ Bars*, and *W5YI Report* for this month's out-of-house news. Keep your news items and photos rolling in to *73 Magazine*, 70 Rt 202 N, Peterborough, NH 03458-1194, Attn: QRX.

Packets Full of Pixels

Packet Scan Amateur Television

by Robert G. Pratt WD8AQX

My many hobbies include amateur radio, computers, and video. I recently discovered a way to combine all three into a fun-filled "super hobby" that results in very-slow-scan television images sent across town or around the world via packet radio.

Packet radio can be used for almost every type of communication, from simple messages and QSOs, to sending computer programs and data files. Once a computer file exists, it is simple to transfer its contents to another station over a packet radio connection.

My first experiments in what I call "Packet Scan Television" (PSTV) took place in early May 1988, shortly after an exciting trip to the Dayton HamVention. One of the things that attracted my attention while nosing around Hara Arena in Dayton early that Saturday morning, was a display by Kinney Software.[1] They developed a computer program and a small video digitizer circuit that could be plugged into the user port of a Commodore 64 computer.[2]

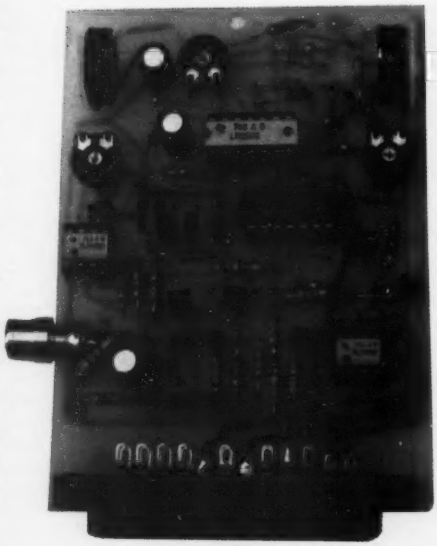

Photo A. Kinney video digitizing circuit.

Their system is designed to take a video signal from a camera or VCR, and convert it into a digitized bit pattern that the computer can display on its screen and store in a disk file. The electronic circuit is a synchronized video sampler which operates under control of the computer. Each horizontal line of the incoming video signal is sampled at a certain point and a pixel (picture element) is collected and digitized. When each line of the incoming picture has been sampled at the same point, a column of digitized video information has been obtained. This is stored in the computer's memory.

The timing is advanced, then a new column is sampled slightly to the right of the previous column. When added to the computer's memory, a new, wider column of video information is created. When the entire width of the incoming picture has been sampled, the computer contains an 8K byte file which fully describes the picture in digital format.

To get you started on this project, Kinney Software offers an etched circuit board, full documentation, and the software to perform these amazing video tricks. The sale price at Dayton was a paltry $35, and I couldn't resist what looked like a bargain. As it turns out, my purchase of their Video Digitizer was a good investment.

On my return home, an extra $20 at Radio Shack provided all the necessary electronic parts. For those less inclined to go shopping, or those who have only a meager spare parts box in the basement, parts kit KVD #01 can by purchased from Midwest Surplus Electronics, PO Box 607, Fairborn, Ohio 45324. The price is $19.95 plus $2.00 shipping and handling.

The Kinney Circuit

This circuit consists of four integrated circuits, four transistors, several capacitors, a handful of resistors, five pots, and a couple of connectors (see Photo A). It took longer to buy the parts than to install them. In a couple of short evenings, it was all together and ready for the smoke test.

One of the nice things about this little gem of a circuit is that it actually worked when I first turned it on. There was no troubleshooting, weeping, or gnashing of teeth. Well, I have simplified it a bit to spare you some of the details. I DID have to adjust the pots. It took about five minutes and was done "by guess and by gosh," with a little help from the Kinney instruction sheet.

Is That Me?

I had set up my video camera in anticipation of the circuit working, but when the screen initially sprang to life under control of the software, there was nothing but a big white square. I studied it carefully, wondering what to do.

I cranked the brightness pot on the circuit board down to ¼ scale, and a black and white scene appeared, showing equipment on shelves and the rear view of a fellow hunching over a computer keyboard. It must be some image they put on the demonstration disk, I thought, although the scene looked vaguely familiar. I leaned back to reconsider.

A few seconds later, the fellow on my screen was now also leaning back in his chair. I'm not always quick to grasp a new concept, but when this one finally sunk in, I let out a shout that the neighbors are still talking about. From that great beginning, everything has continued to go well.

The circuit and software capture a new picture from your camera or VCR over a period of about three seconds. Each sample is digitized by the computer and stored in a bit-map memory. The software (Photo B) allows you to select the gray scale from 2 (black and white) to 8 (six shades of gray between black and white). You can "pseudo-color" the images by substituting other colors for the gray shades. You can also command the computer to save the pictures (black and white only) to the disk and recall them for later viewing.

The on-screen menu (Photo C) also provides for picture storage in formats compatible with other graphics software, such as Print Shop, Newsroom, Koala, and Doodle. This latter feature is a real bonus because it allows you to print the captured pictures on a conventional printer, or use them in newsletter articles. I've tried two of these already and found that Print Shop does a nice job. Newsroom picture printouts, however, appear somewhat coarse and lacking in detail.

A nice feature of the Print Shop program[3] is that the user can add text to the video image

by using some of the commands in Print Shop's Screen Magic section. I tried this by taking a picture of me in my ham shack, facing the camera this time to show my better side (Photo D), then adding my call letters to the lower left corner. It worked fine, and when saved to disk, produced a file that could be read back into the Video Digitizer program for "slide-show" type displays.

The Inspiration

I was chuckling about my great success with this project when another idea hit me. Since I can store the picture in an 8K disk file, why not transfer the file over packet radio to someone else so he can view the picture on his screen, or commit it to posterity on his printer?

Gerry Gomes (WB8RNY) lives about 25 miles south of me, has the same computer I have, the same Kinney and Print Shop software, and a great experimenter's mentality. Gerry and I have whiled away many hours on the Edison UHF repeater while hunched over our computers, desperately trying to untangle the mysteries of wayward electrons.

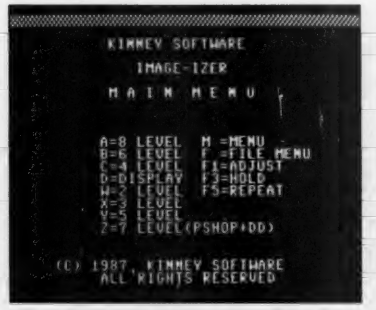

Photo B. Kinney Software gray-scale selection menu.

I called Gerry on the repeater, and he was as intrigued as I was about trying to send my first picture file. It took several minutes to make the packet transfer on 2 meters, then I waited while Gerry loaded the Kinney software.

"What will the picture show?" he wanted to know. "Not a fair question," I said. The real test would be to see if he could figure out what it was.

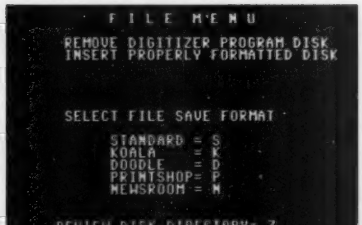

Photo C. Kinney Software onscreen menu. This provides for picture storage in formats compatible with other graphics software.

Photos D, E Photograph of WD8AQX in his shack. . . .and the same image received by Gerry WB8RNY 25 miles away via 2-meter packet video.

The world's longest two minutes passed, then the repeater burst to life again. "Wow, it's your ham shack and you're sitting right in the middle of it!" he shouted. The picture (Photo E) was not as clear as a regular television image because of the lower resolution of the digitizing process, but Gerry was able to describe some of the equipment in my shack, and tell that I had a silly smirk on my face. Not bad for our first shot at "Packet Scan Television."

Gerry then loaded the Print Shop program on his C-64, entered the picture file I had just transmitted to him, and printed a copy of my picture on paper. Although not quite as sharp as the video display, the paper allows you to permanently save a hard copy of the image for decorating a wall or using in a newsletter.

Gerry had not yet built the Kinney circuit when this first great experiment took place, so he was not able to digitize an original picture from his camera. The Kinney disk contains some demonstration pictures, however, and he decided to take one of these, modify it using the Print Shop Screen Magic program, and send the picture back to me so we could claim a two-way video exchange.

A few minutes later my packet TNC sprang to life with a connect from WB8RNY and the picture was on its way. While waiting for the transfer to finish, I grabbed the mike on my UHF rig and made the same mistake Gerry had made earlier. "What will I see?" I asked. "You tell me," he said.

When the transfer was complete, I saved his file to disk, loaded the Kinney "Video"

Continued on page 94

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- Stores Standard Repeater Offsets In Memory
- Full Range of Accessories
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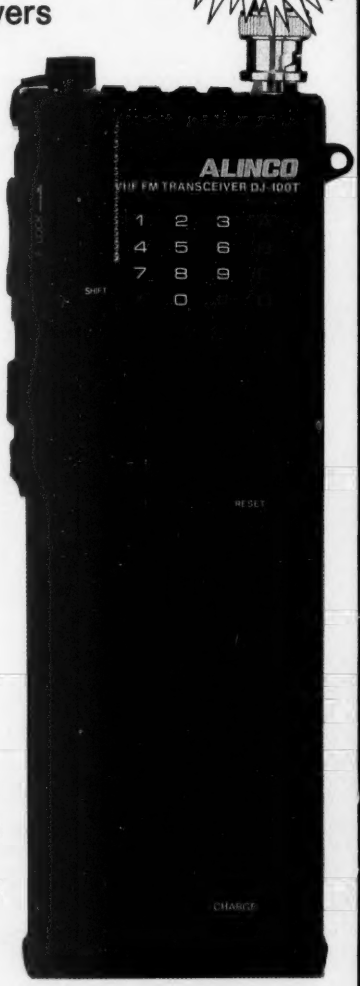

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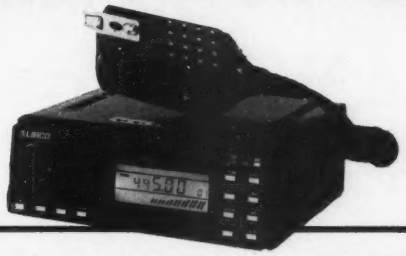
73 Review *by Jennifer Roe WA6OHX*

Alinco 24T 144/440 MHz FM Transceiver

This little rig gets an A+



Alinco Electronics Inc.
20705 South Western Ave., Suite 104
Torrance, CA 90501
(213) 618-8616
Price: $637.95

Most hams shopping for a new mobile FM rig have at least narrowed down the choice offerings from the Big Three manufacturers. I'm here to offer some simple advice to those folks: Wake up! Take a close look at Alinco's 24T. This is one of the nicest, easiest-to-use rigs in its class, and for a very reasonable price.

This little black beauty offers virtually every feature an FMer could desire in a 2½ pound package. Besides two VFOs, 21 memories, and 25 watts on both bands, the 24T boasts a DTMF encoder, subaudible tone encoding and decoding, a built-in duplexer, programmable offset frequency, priority channel designation, and scanning (140–150/440–449.995 MHz). The 5½" by 2" by 6½" package will mount almost anywhere in today's cramped car interiors.

First impressions can make or break a friendship. The 24T's cheerful, informative, light green LCD and simple control layout do not intimidate the new user, unlike so many rigs these days. Every function is clearly labeled, and most are self-explanatory. Three switches atop the unit select scan resumption delay (0 or 4 seconds), scanning speed (4 channels per second or 20 channels per second), and beep on/off. When turned on, the beep reminds the user of frequency changes, especially useful when he or she can't devote any eye time to the rig. A reset switch next to the switches clears all memory and returns the CPU to its factory-programmed state.

Masters of the obvious will, no doubt, wonder at the mic connector missing from the front panel. Not to worry! The rear panel sports a 6" cable with an 8-pin male mic connector, to which the microphone attaches. Similarly, a female UHF connector dangles from another short, rear-mounted cable. Why take up precious front and rear panel space with big connectors? The main advantage of this arrangement seems to be installation flexibility and neatness. No more need for UHF elbow adapters, crimped coax, or panels obscured by cables run amok.

Further, easy access to the antenna connector, the quick-disconnect power cable, and a snap-in mobile mount, cut radio installation and removal time to just a few seconds. In ten seconds or less the radio can be out of sight, secure from prying eyes and fingers at shopping malls or darkened urban streets. The safest radio is one that isn't there to steal.

Travellers or those who change vehicles frequently will like the 24T's small size, light weight, and ease of installation. Solder a cigarette lighter plug to the power cord, throw a small mag-mount antenna into a suitcase, and voila! A complete VHF/UHF station ready for action anywhere.

The rig's 25 watts on both bands let it reach out and touch just about any repeater worth bringing up, and it gives plenty of margin for long-distance simplex operations. With a Bird 4381 power meter and a 50Ω load, I measured 23.5–26.5 and 22–25 watts output on the 144 and 440 MHz bands, respectively. Low power measurements, 6–8W and 5.3–6W, ran slightly higher than the specified 5 watts. The unit draws about 300 mA in the receive mode and just over 5A while transmitting at high power.

Initial set up and operation is straightforward. Turn the power on with the ON/OFF/VOLUME knob, adjust the squelch setting with the concentric ring, and tune to the appropriate frequency with the larger, main tuning knob on the far left of the front panel. The UP/DOWN tune buttons on the hand mic also change frequency. Two small buttons underneath the main tuning knob change the frequency up or down in one megahertz increments. Another small button selects high or low power, and the fourth button in this panel position initiates scanning. Seven of the eight buttons on the rig's right front panel are dual-function. Alternate functions are selected by first pressing the F button, then pressing the correct funtion key.

For repeater operation, the +/− offset key alternatively toggles between −,+, and simplex. Unusual offsets can be programmed simply by hitting F, OW (offset write), and by using the tuning knob to select the correct offset. The user can select 5, 10, 15, 20, or 25 kHz tuning steps in a similar way after hitting F, TS (tuning step).

Storing frequencies in the 21 memories is as easy as one, two, three. The MR key cuts the mode to memory recall. Use the MHz tuning keys to select a memory. Tune the appropriate frequency into VFO A or B, and hit the MW (memory write) key. Memories 1 and 2 contain "call channels," which are frequently used channels you will want to be able to recall quickly with one or two keystrokes (CALL 1, or F, CALL 2). Memories 20 and 21 store lower and upper scan limits, respectively. Scanning in memory recall mode will initiate stepping through all 21 memories. The memories store all programmed information, including offset, subaudible tone selection, and priority channel designation. (The 24T samples the priority channel one second out of every six seconds.)

No options to buy here, either. The 24T includes both a subaudible tone decoder and encoder. The decoder functions as a "tone squelch"; that is, the squelch will not break until the appropriate tone is received. Of course, the encoder transmits a subaudible tone for other transceivers or repeaters employing tone squelches. One of the 37 CTCSS tones are selected by hitting TONE and selecting ENCODE, DECODE, both followed by F, TONE NO. and tuning in the right tone with the main tuning knob.

The 24T features a built-in duplexer. With a single dual-band antenna, the rig can operate in a crossband, full duplex mode. (Use of two antennas requires an external duplexer.) Loading the separate transmit and receive frequencies in the two VFOs and pressing F, DUAL enables this mode. This is also handy for programming non-standard offsets not viable with the OW function.

The Alinco 24T's electret condenser mic sounds pretty darned good on transmit, and its 2 watts of audio power is more than adequate for noisy road conditions. The speaker is on the bottom, suitable for most installations. Those not satisfied with the rig's internal speaker can always plug an 8Ω external speaker into the jack in back.

Packeteers should rejoice to find adequate audio qualities and performance for their favorite mode. On the down side, Alinco does NOT provide audio on the mic connector. However, pin 6 is left free for what should be a relatively easy modification to correct this deficiency.

This rig is, in a word, HOT. It looks and sounds good. There are no nasty surprises like three-handed control combinations. There are NO options to purchase for full-featured operation. Above all, the price is fantastic.

A Trip Through The Microwave Spectrum

Up, Up, and Away . . . . . to 10 GHz!

by Pete Putman KT2B

Let's try something fun for a moment. Grab a ruler, or a tape measure if it's handy. Got it? Pick up a pencil and draw a line 5" long. Now use the ruler to divide it in half, just over 2½". Finally, divide that line in half to 1¾".

You have just sketched the dimensions of a quarter-wave antenna for the 13 centimeter band—2.3 GHz, which is 2300 MHz, or 2,300,000,000 Hz. (That's a LOT of Hertz!) Pretty small, isn't it?

The thrust of this introduction to the amateur microwave bands is think small. On the other hand, we can also think BIG while we think small, and I'll show you what I mean as we move on.

Overview

The majority of amateurs are active on the HF (High Frequency) bands—that is, 160 through 10 meters. These are the first frequencies on which most operators get up and running. A considerable number of hams venture higher, to 6 meters, 2 meters, 1.25 meters, and even 70 centimeters, which is as high as most of them will ever go.

But to think that life ends after 450 MHz is grossly in error. The biggest chunk of spectrum allocated to the Amateur Radio Service lies above 900 MHz, where one band alone (23 centimeters) is larger than the combined bandwidth of all allocations from 160 meters through 220 MHz! That's a lot of room to play with, and the room is largely empty most of the time.

For whatever reason, the bands above 900 MHz are underused by most amateurs. Could it be ignorance? Reluctance to spend money? Little or no understanding of propagation at these frequencies? Probably a combination of all three! Well, grab your hats and come aboard for a short flight over the "Uncharted Territories" as we unravel some of the mysteries of microwaves!

The 902 MHz (33 Centimeter) Band

Compared to its higher-frequency cousins, 33 cm is just coming into adolescense. Yet it's a "hot" band of late, with a preponderance of schematics for preamps, converters, transverters, and amplifiers showing up in numerous publications. The allocation is actually from 902 to 928 MHz, but for the moment most activity is taking place near the low end of the band, between 902 and 904 MHz.

". . . (23 centimeters) is larger than the combined bandwidth of all allocations from 160 meters through 220 MHz!"

A half-wavelength at 33 cm is roughly 6½" long, making designs of high-gain antenna arrays quite simple. Two popular yagis are (1) Conventional half-wave element types and (2) Full-wave loop designs. As I mentioned earlier, thinking "small" allows us to think "big," which translates into multi-wavelength booms for higher forward gain and fairly narrow beamwidths.

Since 33 cm lies just above the cellular telephone frequencies, much surplus cellular equipment has been modified (or stripped for parts) and incorporated into amateur stations. Many semiconductors developed for cellular operation are easily obtained at a reasonable price, and a number of designs based on commercial power modules have sprung up in amateur microwave newsletters.

At the moment, there are no manufacturers in the USA or Japan with a line of amateur transceivers for this band. There is a mobile citizen's radio service in Japan which uses low-power FM equipment in the 900 MHz range, and perhaps some of these units will make their way across the Pacific. Currently, only SSB Electronics of West Germany, and LMW Electronics of England, manufacture linear transverters for 33 cm. Both models accept all modes (except ATV) and run about 20 and 6 watts output respectively, using a 144 MHz IF. For ATV buffs, PC Electronics of California sells a 33 cm transmitter with the capacity for audio subcarrier.

Propagation at 902 MHz closely resembles that found on the 23 cm band (1240–1300 MHz). Radio waves at this frequency propagate line-of-sight and are largely limited by atmospheric attenuation. Obstacles such as densely foliated trees, large buildings and hilly terrain, can become formidable obstacles to the average 33 cm signal! The quantity of precipitation in the air can also degrade communications.

For the average home station running 5–10 watts to a single loop/dipole yagi, communications from 25 to 50 miles can easily be reached with smooth terrain. The fun begins when atmospheric conditions form temperature inversions, layers of cooler air trapped between layers of warmer air. This phenomenon creates something approximating a "duct" (such as that in air conditioning), and 33 cm signals entering the duct may come from hundreds of miles away.

Such paths have occurred from the central states to the northeast, across the Gulf of Mexico, along the Atlantic coast, and even from Hawaii to southern California. While the path from Hawaii to Los Angeles has been worked on all bands from 144 through 1296 via tropo, it remains to be done on 33 cm. As of this writing (7/10/88), the record for a 902 MHz contact is 623 miles, between Texas and Florida.

The 1240–1300 MHz (23 Centimeter) Band

Of all the bands above 900 MHz, 23 cm is probably the most accessible at present. It's a worldwide allocation (unlike 33 cm), and many transverters, transceivers, antennas, preamps, and amplifiers are available for it. For those inclined to homebrew, circuits

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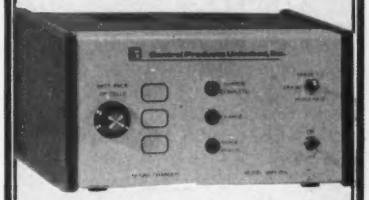

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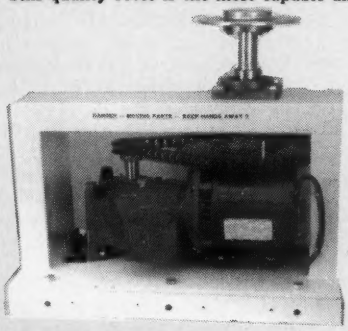

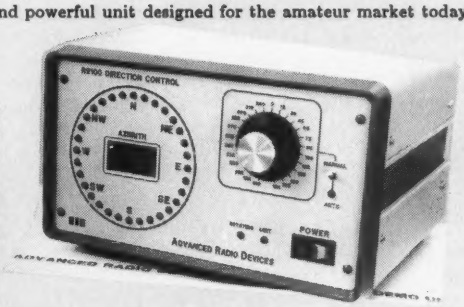

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abound to help the ham get up and running in a hurry.

23 cm has been in the allocation tables for quite a while, and a detailed band plan exists supporting a variety of modes, including packet, SSB/CW, ATV, and satellite operation. A half-wavelength at 23 cm is about 4½", making the design of high-gain yagis quite easy. Many 23 cm designs have been scaled down to 33 cm with excellent results, and solid-state amplifier designs for 23 cm have also been used this way.

23 cm is also part of the Enhanced Novice allocation, and this, coupled with the popularity of the band overseas, has led to a major commitment by the large manufacturers to 23 cm transceivers. Kenwood, ICOM, and Yaesu all manufacture FM handhelds and mobile radios for 23 cm, while ICOM and Yaesu also make multi-mode base station transceivers. On the transverter side, SSB, LMW, and Microwave Modules all make high-performance equipment. SSB and Down East Microwave sell a full line of solid-state "bricks" (amplifiers). Antennas are available from KLM, Tonna, Larsen, J-Beam, and Down East. PC Electronics also makes a nice 23 cm ATV unit.

Moonbounce (EME) operation is quite popular on 23 cm, partly because a high-gain array of yagis (or even a dish) doesn't take up much room. Many weak-signal operators around 1296 MHz are running some truly monster arrays. How about four 55-element yagis on an H-frame? (Imagine running 220 elements on 2 meters!) Propagation is very similar to 33 cm, with everyday communications possible over a 25–50 mile path on smooth terrain.

Tropospheric enhancement can produce spectacular results on 23 cm. During the June 1988 VHF Contest, daytime SSB/CW contacts from the eastern shore of Virginia to New York City, Long Island, and South Jersey, produced signal levels in the S-1 to S-3 range. However, at about 9 PM, the same signals were literally 60 dB over S-9 due to tropospheric enhancement. The reason? The ocean cools off faster at night than the shore areas, and tropo "ducts" were formed.

From late summer through late fall, tropo enhancement can often occur many miles inland. A tremendous opening in late November 1986 resulted in hundreds of 1296 contacts between stations in New York, Pennsylvania, and Ohio, and stations in Texas, Oklahoma, and Kansas. In many cases, both sides were running under 10 watts output to modest antennas . . . . . testimony to the power of a tropo opening!

The 2300–2450 MHz (13 Centimeter) Band

13 cm has been coming into its own lately, with a general upswing of interest along the East Coast, central Midwest, and Southern California. A half-wavelength at 13 cm is just 2.5", making the construction of a conventional dipole-element yagi somewhat difficult. Here is a band in which dish antennas start to look more attractive, but the ever-present loop yagis are quite practical as well.

All modes are permitted on 13 cm, but the most popular are SSB and CW weak-signal work. 13 cm is also used for remote FM links and control lines in areas where high mountains offer line-of-sight paths to urban areas, and telephone lines would be impractical. Satellite operation is now available with the addition of a 13 cm downlink from Phase 3C, using a beacon at 2400.325 MHz and a Mode "S" uplink/downlink from 435.600 to 2400.700 MHz.

13 cm tends to be an experimenter's band due to the lack of commercially-manufactured amateur equipment. Only two companies make transverters for this band—again, SSB Electronics and LMW Electronics. Another stumbling block for potential builders is the lack of linear solid-state devices for power levels over 1 watt. Most designs adapted from commercial or military devices rely on 26-volt supplies and grounded-base bipolar transistors. As such, they run Class C only, but this is not a problem when operating CW.

The limitations of low power are more than made up by larger antenna arrays, such as 4 to 10 foot dishes or multiple-bay loop yagis. A fly in the ointment is the considerable losses incurred in conventional transmission lines at this frequency, as the dielectric tends to absorb RF energy. Most serious 13 cm operators use ⅞" hardline, and even it has moderate losses at this frequency.

Despite the drawbacks, propagation at 2300 MHz can be extensive. A modest station running 1–2 watts to a 20 dB antenna should be able to work about a 10 to 15 mile radius from the home station. Longer paths can be worked during periods of enhancement, and a well-equipped station running 50 to 100 watts to a 20–23 dB array might be able to work over 200–300 miles if conditions are right.

Precipitation poses a major hurdle, as large raindrops or snowflakes tend to reflect or refract the signal away from its intended recipient. Indeed, many 13 cm operators work each other along partially-obstructed paths, taking advantage of consistent refraction by nearby hills or buildings. Stations have even worked via "airplane scatter" where the signals have used a 747 passing overhead as a reflector. This technique has also been tried on 23 cm.

The 3300–3500 MHz (9 cm), 5650–5925 MHz (6 cm), and 10000–10500 MHz (3 cm) Bands

Here is some truly uncharted territory. Talk about available spectrum space! The 3 cm band alone is bigger than ALL amateur allocations through 13 cm. These are truly the "millimeter-wave" bands, with a full wavelength at 10,000 MHz (or 10 GHz) measuring just over 1 inch. As might be expected, construction of conventional yagis would be all but impossible here, so waveguide and feedhorns are the preferred method of transmission, either directly or to illuminate a dish.

Virtually anything can send a signal from these bands astray: A bird flying in front of a dish, tall buildings, vehicles, dense raincloud or foliage. These are literally "line-of-sight" frequencies. Power generation at these frequencies is not an easy task. Most stations are typically running under 1 watt, often at less than one-tenth of 1 watt.

Two modes predominate here: Wideband FM, employing Gunnplexers or similar Gunn diode oscillators, and narrowband CW/SSB, using transmit/receive converters with intermediate frequencies at 144 MHz. Virtually all of the equipment used on 9 cm and 5 cm is homebrewed, while there are at least two commercial units on 3 cm, the SSB Electronics Microline Transverter, with about 100 mW output, and the previously-mentioned Gunnplexers, with 10 to 20 mW output.

Signals can also be enhanced by tropospheric effects (although to a far lesser degree than on 903 and 1296). The record for a 2-way 10 GHz path was set from the coast of Spain to an island in the Mediterranean Sea—a path entirely over water. In this case, the ducting was used as an extended waveguide to get more mileage out of the milliwatt signal levels.

Summary

The frequencies from 900–10000 MHz represent a vast resource that lies largely untapped by all but a small percentage of amateurs, yet nowhere else in the spectrum do we have the space to run virtually all modes with little or no QRM, and minimal interference from inclement weather. Although high power levels are harder to obtain, higher gain antennas more than compensate.

This "trip" has been by no means conclusive! I have purposefully neglected the bands above 10 GHz due to the limited scope of this article. If you are stimulated to try operation on one or more of these bands, I suggest you obtain copies of the following publications: (1) *The ARRL Handbook*, 1988 Edition, (2) *The VHF/UHF Manual*, by G.R. Jessop, (3) *The Proceedings of the 1987 Central States VHF Society Conference*, (4) *The Proceedings of Microwave Update '87*, and (5) *Proceedings of the Mid-Atlantic VHF/UHF Conference*. All are available from the ARRL Publications Dept.

You may wish also to subscribe to any of the numerous regional newsletters that detail UHF and microwave operation. Three good choices would be the *Midwest VHF Report*, published by Roger Cox WBØDGF, 3451 Dudley St, Lincoln NE 68503; *VHF/UHF and Above*, published by Rusty Landes KAØHPK, PO Box 126, St. Mary of the Woods, IN 47876; and *Feedpoint*, published by the North Texas Microwave Society, c/o Wes Atchinson WA5TKU, Rt. 4, Box 565, Sanger TX 76266. Another newsletter, which has some excellent circuit ideas from time to time, is *Cheese Bits*, published by the Mt. Airy VHF Radio Club, c/o Harry Stein W3CL, 2087 Parkdale Ave. Glenside PA 19038. 73

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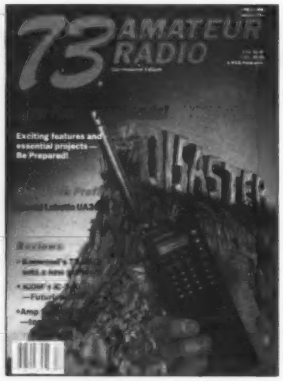

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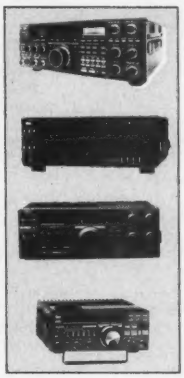

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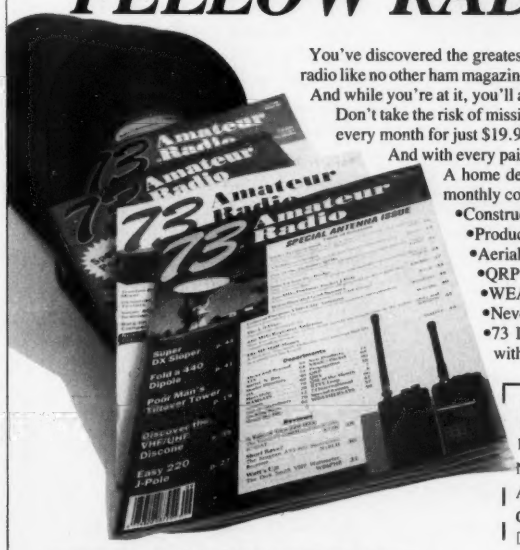

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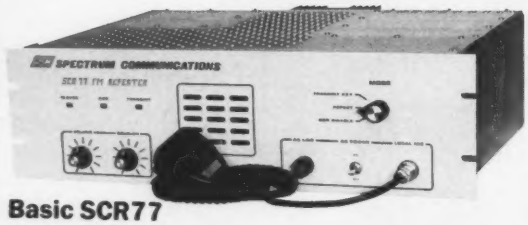

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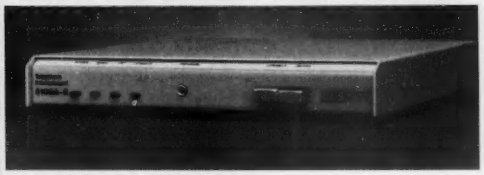

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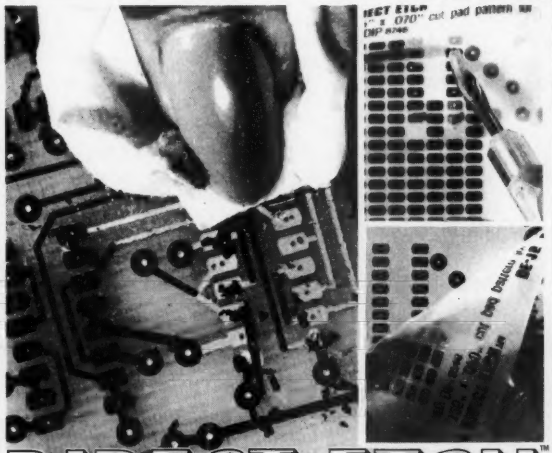

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10 GHz Polaplexer Transceiver

A unique system for full duplex operation on the 3 cm band.

by C.L. Houghton WB6IGP

The construction of the polaplexer transceiver was prompted by W6OYJ and others who needed circulators for their own projects. A very simple 10 GHz transceiver could be built but required a circulator, a hard-to-find and expensive component. The point we were trying to accomplish was an inexpensive alternative that could provide excellent performance and an easy construction project. This approach goes back 30 to 40 years and involves many amateur's efforts, including W6IFE and W6VIX. Ed W6OYJ's design is quite simple and uses only one out-of-the-ordinary component—a Teflon™ rod.

Required Components

The shopping (junkbox) list includes a Gunn diode, a short section of WG-16 waveguide, brass shim, 1/16″ brass rod, and a 1″ piece of Teflon™ rod. Those with their own Gunn oscillator will not need the Gunn diode. I used a Solfan intrusion alarm Gunn oscillator that I found at a burglar alarm company. The power output of this unit normally is 5 to 10 mW. After substituting a higher power Gunn diode, however, the unit now produces 100 mW output. I was able to obtain a large quantity of high power Gunn diodes for 6, 10, and 18 GHz operation. You can easily find the remaining pieces in most local well-stocked hardware stores or at the local swap meets and surplus dealers. The high power Gunn diodes I have made are available for amateur radio construction. I will make a kit of these components available to those not able to locate them.

Easy Design

The design of the polaplexer is very simple. It uses standard plumbing brass tube found in a bathroom water closet as an overfill pipe. The cost of these pipes is about $2.50 in most hardware stores. One end of the tube is fitted with a waveguide flange, that is turned out on its center to fit the outer diameter of the 1″ brass pipe. Through this flange is where the Gunn oscillator attaches. This can take several forms, including the familiar intrusion alarm microwave units or a homebrew Gunn oscillator made out of a piece of WG-16 waveguide. In either case, the oscillator is coupled through a Teflon™ transformer which is positioned just inside the mounting flange on the inside of the 1″ brass tube.

The Gunn oscillator serves both as the transmitter and injection oscillator for the detector mount. The transmitter is frequency modulated by varying the power supply voltage. On receive, a small portion of the oscillator power is coupled into the detector. The difference frequency, 30 MHz in this case, is detected by the mixer diode and amplified by the following IF stage. The sensitivity of this polaplexer is quite competitive with a good circulator and performs quite well. It is especially good when used with a quality low-noise detector diode. I use a Microwave Associates (M/A COMM) 1N23WG with a maximum noise figure of 6.5 dB.

Approximately 30 dB of isolation between transmit and receive is achieved due to cross polarization in the circular waveguide. When using a polaplexer, offset the unit 45 degrees from true when working vertical Gunn units. The convention is to rotate the receive off vertical towards the right when facing the distant station. When operation is with other circular units, no offset adjustment is necessary. See the system photographs and Figure 1 for details. Add to this package a simple regulated power supply of about 10 volts DC with an IF amplifier operating at 30 MHz for the detector IF output and you are nearly ready to put this system into operation.

Making The Flange

The heart of the system is a 5 13/64″ section of brass tubing. I first mounted the tube into a flange that was prepared by opening the 1 by ½″ normal rectangular to a full circular to accept the 1″ brass tube's OD in a slightly tight fit. I used a lathe to cut open the waveguide flange, and fashioned a square piece of brass plate with a center cut hole to fit the 1″ tube.

After assembly, polish the finished flange

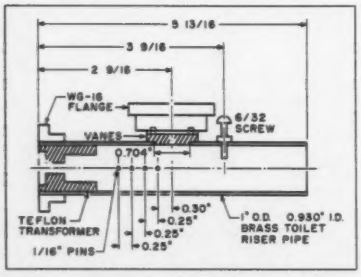

Figure 1. Cut-away profile of the circular waveguide, with the Teflon™ piece inserted.

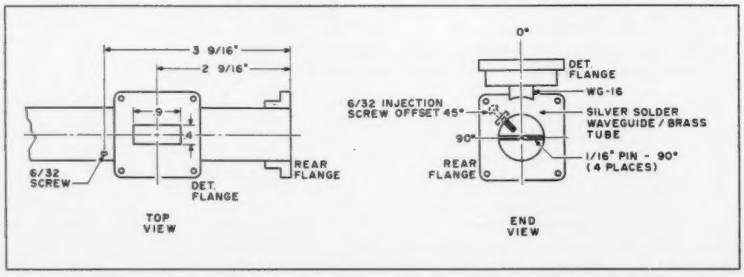

Figure 2. Two views of the circular waveguide. The left diagram shows the top view, with the square figure in the center as the detection flange. The right diagram shows the end view.

and joint end surface on a flat surface with a fine piece of 400 grit sandpaper to make the flange's fit tight and uniform. Place the paper on a small piece of glass scrap to maintain the flat surface when polishing. For home-brewing flanges, I suggest using 3/16- to 1/4 "-thick brass plate. After checking for good fit, remove the rear flange for attachment.

I then removed a short section of waveguide with the flange attached to serve as the detector mount. This section of waveguide need be only about ¼" long, extending out of the back of the flange. Cut one off from some scrap piece of waveguide with the flange attached. File the end of the waveguide to fit the curvature of the outside of the brass tube, taking care to align the waveguide length parallel to the tube length. Mount the flange centered 2 9/16" (2.5625") from the end of the brass tube. The center measurement is from the inside of the waveguide. See Figure 2 for placement of the detector flange on the brass tube.

Detector Construction

With hard silver, solder the short piece of waveguide to the side of the brass tube. Make sure to remove any solder that flowed inside, so the inner surface is a smooth transition from brass tube to waveguide—excess solder is quite messy. The primary reason for using hard silver solder is so it will stay intact when other parts are soft-soldered to the polaplexer. Don't ruin a careful and time-consuming alignment with quick construction methods and soft solder! Also, place moist paper towel into parts of the soft-soldered to keep excessive heat from desoldering them.

Verify the alignment of the half-finished assembled polaplexer after the silver soldering operation. If in good order, remove the brass tube inside the waveguide fitting by drilling some of the center material away. Fine-file to keep from scoring the waveguide itself. Caution: Do not remove the small edge lip of the brass tube as it extends into the inside of the flange for 0.150" on either side of the inside of the waveguide fitting, 0.9" length side of waveguide. See Figure 3 and 4, inside of waveguide detail.

Detector Vanes

Now prepare the brass vanes for insertion into the waveguide opening. The space is an equal distance across the width of the detector coupling. Fit them with a section of brass on the top section, approximately 0.4" by 0.1". All parts are made from brass shim stock about 0.010" thick. I prepared the parts by cutting all components and trimming them to fit. I then made a jig, with small pieces of wood scraps, to hold the two vanes in position while I silver soldered the two top pieces together. I soldered the top of the vanes to the bottom of the top plate (0.4 by 0.1") using a small amount of silver solder to tack the pieces together.

Once the vanes were fitted in, I cleaned up the part by removing excess solder, and begin fitting it inside the flange for good fit. It requires patience, since it will more likely move the vane part during soldering. File to fit the scale shown in Figures 3 and 4. The vanes are soft-soldered into the waveguide for a final fit. After all other operations are completed, set them aside for the time being.

Detector Pins

See Figures 1 and 2. Four holes are now drilled into the brass tube. The first hole is located 0.30" back towards the end of the tube from the center of the attached waveguide detector mounting flange. This hole point is centered on the brass tube and is perpendicular to the axis of the detector flange. Make sure the drill press does not wander and that the hole drilled is centered and uniform on both sides of the tube. I used a 1/16" bit in my drill press and a short section of angle bracket to hold the brass tube in a bench vise while drilling.

I used a small guide drill about 0.030" to ensure that the holes are centered where I want them. It is not necessary to drill through the material—it just provides a guide. I avoided center-punching for fear of scoring the material.

The other three holes are 0.25" center-to-center apart from the first pin. I tapped the pin in with mild force as the brass rods were a tight fit. I suggest cutting off the excess with wire cutters, since bending to hold in place distorts the inside position. Soft-solder both sides of each pin to the outside of the brass tube. Note that a tight fit keeps excess solder out of the inside of the circular waveguide.

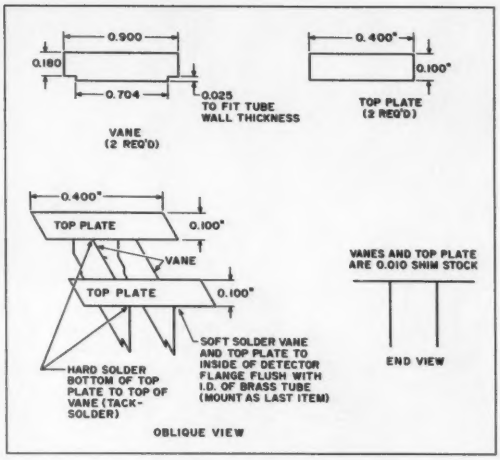

Figure 3. Details of detector vane mounting.

Injection Screw

The oscillator injection screw is mounted 45 degrees offset from the perpendicular plane line of the detector flange of the 1/16" pins. A 6-32 screw is inserted into the guide to act as the injection coupling into the detector mount. It controls the amount of oscillator power to inject into the detector diode. It's located 3 9/16" from the rear flange. See Figure 2.

Mount the rear flange to the tube with its bolt holes aligned to the oscillator unit. Make sure the wide internal section of waveguide is in the same plane as the 1/16" pins below the detector mount. Then soft-solder the rear flange. As a last point, soft-solder mount the vanes to hold them more firmly in place.

Operation Modes

The input end of the brass pipe is actually a circular waveguide and is operating TE-11 mode. To this flange the Gunn oscillator is attached. Use a home-brew job or a surplus Solfan oscillator. The orientation of the flange and the Gunn oscillator is in respect to the four pins centered in the circular waveguide. They are parallel to the broad face of the Gunn oscillator 1" wide opening (0.9" inside dimensions). See Figure 2. Both flanges are bolted together in normal operation through the four bolt holes located in the corners of the flanges of the Gunn mount and the circular waveguide flange.

Teflon™ Transformer

The neat trick required at this point is coupling the rectangular waveguide to the circular waveguide. The key player is a one inch stock piece of Teflon™ rod, which is cut to fit inside the circular waveguide flush with the end of the flange. Build the Teflon™ transformer by milling or drilling a series of cuts and depressions in the front and rear face. This accomplishes the required transformation from rectangular (TE-10) to circular waveguide (TE-11) mode. Its operation can best be explained one of two ways: A dielectric lens through which the microwave ener-

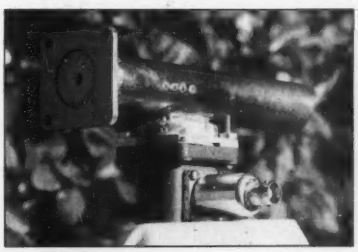

Photo A. Rear view of polaplexer showing Teflon™ transformer and four brass pins on the side of a 1" tube. Detector mounted on polaplexer.

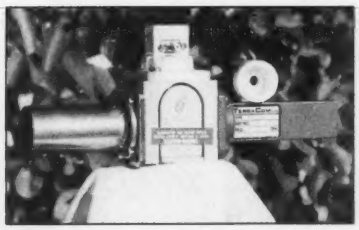

Photo B. Test circulator with short section of circular waveguide. It couples the noise generator to the circular waveguide to allow the evaluation of the polaplexer.

Photo C. Completed polaplexer mount with Solfan Gunn oscillator attached.

gy is forced to travel and arrives after going through the insulating material, in a new relationship in respect to the original signal (plain old obfustication), or just simply black magic! I prefer the latter explanation.

N6IZW, experimenting just for fun, inserted a solid hard rubber *dog ball* in the open end of a radiating waveguide. Its shape made it behave like a lens or magnifying glass which gave (a little) gain to the microwave signal. It collimates the microwave energy into a focused point due to the different travel times through the dog's ball.

Teflon™ Tooling

Machine the Teflon™ transformer to fit inside the brass tube. The transformer resembles a handle-less beer mug with a hole drilled through the center of its bottom. It should be 0.843″ long and about 0.930″ wide to fit snugly inside the circular waveguide brass tube. Different suppliers have a slightly different wall thickness in their brass tube, so cut to fit the individual tube.

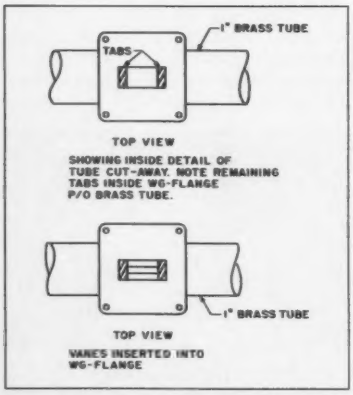
1" BRASS TUBE
TABS
TOP VIEW
SHOWING INSIDE DETAIL OF TUBE CUT-AWAY. NOTE REMAINING TABS INSIDE WG-FLANGE P/O BRASS TUBE.
1" BRASS TUBE
TOP VIEW
VANES INSERTED INTO WG-FLANGE

Figure 4. Insertion of the vanes into the waveguide flange.

Photo D. Ed W6OYJ on Mt. Soledad, using the polaplexer, Solfan Gunn oscillator, and home-brew 30 MHz receiver. Ed is looking through a bore-sight tube mounted on the dish.

The center of the Teflon™ is drilled with a 0.218″ diameter hole (13/64″ drill bit = 0.203″) through the Teflon™ center. One end of the Teflon™ transformer is machined out, centered on the 0.218″ bore, a 0.750″ wide cut 0.031″ deep. The other end of the Teflon™ transformer has a similar cut 0.684″ wide centered and 0.450″ deep. This gives a simple transition between rectangular waveguide (TE 10 mode) and circular (TE 11 mode).

With care, machine the Teflon™ piece on a lathe. I made a perfectly adequate transformer on a drill press using bottom cutting bits for the inside depressions in the Teflon™. Use the center hole of the Teflon™ transformer as a guide placed over a wood dowel, pinned to a large board fixed to the drill table. Using a small end bit, as a mill turning the Teflon™ part on the pin, will control the cut in the soft Teflon™ as to depth and edge cut. It takes some time, but works quite well. Fix the position of the board with one or two clamps to hold the position securely while turning the Teflon™ part. Use safety glasses and care when working with any power tools. See Figure 5 for dimensions on the Teflon™ transformer.

Detector Mount

Refer now to Figure 6. A detector mount using a low noise M/A COMM 1N23WG diode attaches about halfway forward on the brass tube to the detector flange. Cut a hole through the brass tube inside the detector flange 0.4″ by 0.704″ after the flange is hard-soldered to the tube. The detector mount can be a surplus mount or can be built out of a short piece of waveguide.

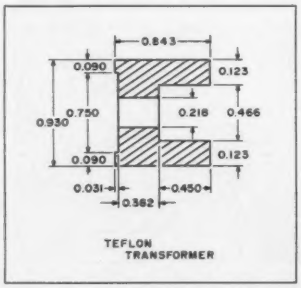

Figure 5. Cut-away profile of a Teflon™ transformer.

Gunn Oscillator

It is not important what Gunn oscillator is chosen, all that is needed is a source of 10 GHz energy.

I used one of the Solfan 10 mW output oscillators on my first home-brew project. Set the oscillator near the frequency of interest, say 10.250 GHz, and attach the Gunn oscillator to the rear flange. Couple to the detector flange the diode detector. Make primary adjustments with a current meter in series with the crystal detector. Adjust the depth of the coupling screw (6/32) to obtain about 0.8 mA as indicated on the series meter, then lock the screw in position. Coupling the detector to an IF strip provides a completed full-duplex transceiver. I normally have a single stage low-noise pre-amp between the detector output and IF input. I use a single U-310 FET in grounded gate, feeding one of my single chip receivers operating at 30 MHz (TDA-7000 Signetics chip).

Best DX So Far

The best DX using one of these units with a two foot dish was about 110 miles to Heaps Peak from Mt. Soledad in San Diego by W6OYJ. Ed was using one of my TDA-7000 IF amp receiver boards operating at 30 MHz, approximately 70 kHz bandwidth. The construction of workable microwave transmitters and receivers is not magic—they can be built at home with a limited workshop.

Kit

I have a kit of raw materials to build this polaplexer mount for those not able to find them locally. The kit includes a short section of WG-16 waveguide, a piece of Teflon™ rod, 1/16 brass rods and shim stock for the vanes. Cost is $7.50 post paid. Also available is a 50–100 mW output Gunn diode tested at 10.250 GHz for $5 post paid, or both items for $11 postpaid from the author. Other Gunn diodes tested with output of 100 mW and up are $10 each.

One final piece of advice: Get the *RSGB Handbook*. It's an excellent authority on microwave, a source I wouldn't be without.

I would be glad to answer any questions concerning this project or any other microwave related items. For a prompt reply, please include a SASE. See you on 3 cm! 73

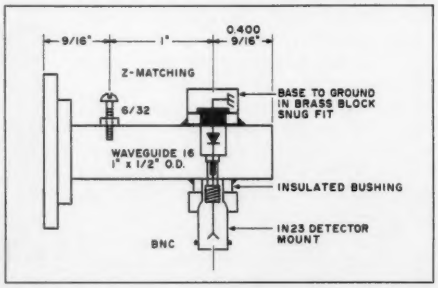

Figure 6. Side view of circular waveguide showing detector mount.

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VHF/UHF Tape Antennas

Easy-to-make VHF/UHF copper foil antennas.

by Fred Graham WB3KCZ

Antenna experimentation and construction on the 144 MHz, 220 MHz, and 440 MHz amateur bands is often cheap and convenient due to these frequencies' short wavelengths. One such simple beast is the tape antenna.

Materials

BNC Female to "F" Male Adapter	Radio Shack #278-256
Copper Foil Tape	"Venture Tape" Venture Tape Corp. 30 Commerce Road Rockland, MA 02370 (617)-871-5964
Plastic Sheet	Mylar,™ Polyester, Acetate, etc. NTC Plastics
TV Matching Transformer	International Model A-MT75-300

An Idea Is Born

I often sketch antenna designs on large engineering graph paper. Frequently, I had to recalculate and redraw the designs to visualize how certain modifications would affect antenna operation. It was while drawing a design for a 440 MHz antenna that I realized that the actual dimensions of the antenna were fitting on my graph paper. Voila!—if I could replace the pencil lines on the paper with a conducting material, I could test the antenna with a transceiver and easily trim and adjust it for best results.

The Materials

Narrow, adhesive-backed copper foil tape used in making stained glass, available in hobby shops, was the perfect choice. When the antenna is laid out on clear Mylar,™ acetate, or polyester sheets, it can be pinned to the wall or ceiling for testing. Modifications are easy to make with an X-acto knife and soldering iron.

The clear plastic sheeting, 0.003″ to 0.005″ thick, is usually available at art supply stores. I found I could buy rolls 12 feet long and 40 inches wide. These dimensions allowed me to experiment with full-sized, multi-element antennas for two meters.

The following describes a simple folded dipole antenna for 2 meters that can be mounted, for vertical or horizontal polarization, either on the wall or ceiling of the shack with push-pins. It has a professional appearance. Since the folded dipole has a balanced input impedance of 300Ω, I used a TV matching transformer to convert the unbalanced 52Ω output of my handheld to approximately 300Ω at the antenna. These small transformers work quite well up to the 5 watt level and can be used at 440 MHz. I have not tested the transformers beyond 5 watts, but I have loaded them with 300Ω carbon resistors at 440 MHz, and measured virtually no loss or reflected power.

Not Always "492/f"

The resonant physical length of the antenna will vary according to its proximity to the wallboard material on which it is mounted. I have found that mounting the antenna on "Dry Wall" requires about a 20% shortening of the element from the value given by the expression: 492/f (MHz). If the antenna is suspended in free space it will only have to be shortened slightly, i.e. 5%, to compensate for the dielectric constant of the plastic material on which it is mounted. The dimensions given in Figure 1 are for an antenna constructed on polyester sheeting 0.003″ thick, mounted directly on "Dry Wall" wallboard.

Although the antenna's length has to be adjusted for proximity to the wallboard, its operation is not otherwise affected. The transmitted and received signals will show dramatic improvement over signals with "rubber duck" antennas. Take care not to mount the antenna near any hidden AC power lines inside the wall. The feedline to the matching transformer can be any length of RG/58 or RG/59 coax, preferably with BNC connectors at each end. Buy an adaptor to convert the BNC connector to the "F" style connector on the matching transformer. Better yet, use a cable with a BNC on one end and an "F" style on the other—this saves both the cost and the electrical loss of the adaptor.

The folded dipole exhibits wider bandwidth than a single conductor dipole—it's possible to cover each of the 144, 220, and 440 MHz bands with a single antenna.

Folded dipoles with other than 300Ω feed impedances are easily built by varying the width and spacing of the dipole conductors. The copper tape is available in widths from 5/32″ to ¾″. The *ARRL Antenna Book* gives details for various folded dipole feed impedances.

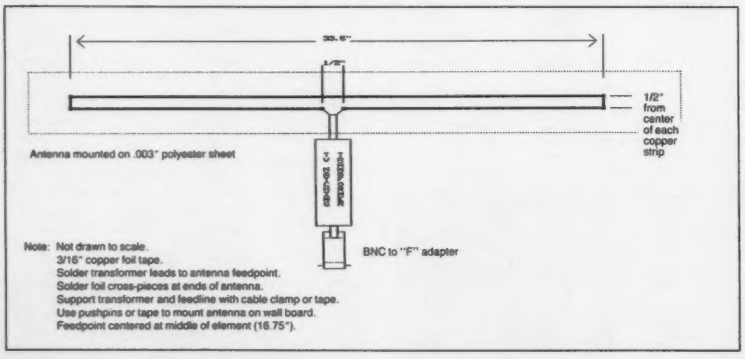
1/2"
1/2" from center of each copper strip
Antenna mounted on .003" polyester sheet
BNC to "F" adapter
Note: Not drawn to scale.
3/16" copper foil tape.
Solder transformer leads to antenna feedpoint.
Solder foil cross-pieces at ends of antenna.
Support transformer and feedline with cable clamp or tape.
Use pushpins or tape to mount antenna on wall board.
Feedpoint centered at middle of element (16.75").

Figure 1. Two meter copper foil folded dipole.

Antennas In The Works

I am presently working on versions of the J-pole, vertical phased array, and log periodic antennas for wall mounting on thin plastic sheets. I am also considering different methods of supporting these antennas and giving them rigidity so they can be hung from the ceiling and directionally rotated.

Conclusion

These two-dimensional copper tape antennas are very easy to put together. They provide an inexpensive and convenient way of experimenting with interesting antenna configurations to use in the VHF and UHF amateur bands. The TV matching transformers work very nicely as broadband 4:1 balun transformers up to 5 watts, and at frequencies as high as 900 MHz. Have fun! 73

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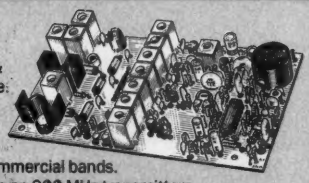

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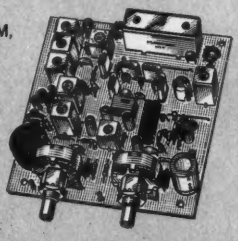

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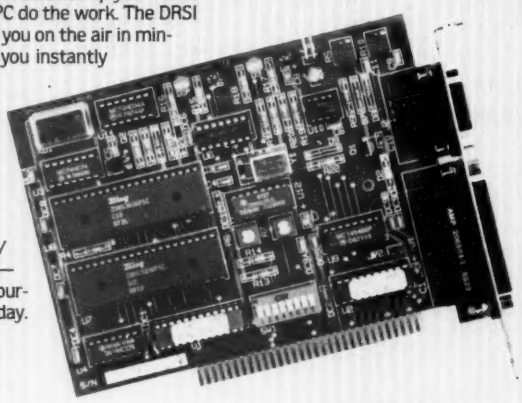

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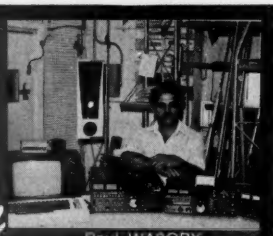

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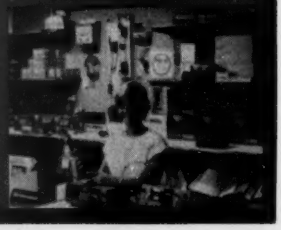

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73 Review by Pete Putman KT2B

SSB Electronics LT-33S

902 MHz Linear Transverter

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Price Class: $600

The 33 centimeter band (902–928 MHz) is to many amateurs today what 1296 MHz was 20 years ago: uncharted territory with lots of potential. The increased availability of commercially-manufactured equipment for 23 cm has taken away much of its mystery. SSB Electronics of West Germany has been in the forefront of supplying such equipment with their now-famous LT-23S linear transverter. It stood to reason that when 902 MHz became available, they would follow up with a similar unit, the LT-33S. (Photo A.)

Both the LT-23S and LT-33S share many things in common, not the least of which is overall appearance. The same housing has been used with a slightly modified front panel. From left to right, rocker switches control LO selection, TX, and Power On. A meter has been included to show relative output power—unlike the LT-23S it is illuminated, which is a nice touch.

Rear panel connections are also similar: BNC input for the 144 MHz IF, BNC input for the 902 MHz receive input, and a type N connector at the output of the PA board. Note that (as on the LT-23S) no T/R switching is included and an antenna relay must be added. SSB also brings +13.8 VDC out to a separate binding post which activates on receive and drops out on transmit. This scheme, incidentally, protects mast-mounted preamps, though I still encourage using a sequencer instead.

Most of the circuitry in the LT-33S derives from the 1296 MHz unit. The major difference is in the final amplifier which incorporates a pair of Phillips ON4284 devices in parallel, as opposed to the LT-23S which uses 2 BLU99s in the same configuration. Amplifier operation is in Class AB1 mode, grounded emitter for a truly linear signal. What goes in comes out, whether it be SSB, CW, AM, or FM.

The final amp now uses ON4284 devices because the BLU99s kept failing at 902 during high VSWR stress tests. Conversely, the ON4284 does not have significantly more gain than the BLU99 at 1296; hence the two different types of finals in the two transverters. The good news is that the 902 final configuration produces over 20 watts output saturated, which is a good amount of drive when using an outboard tube amplifier. It's also plenty of power for QRP work as well.

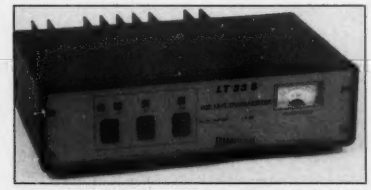


Photo A. SSB Electronics LT-33S 902 MHz transverter.

The front end device is an active RF amplifier using the time-honored Mitsubishi MGF1302, rated at about 1.3 dB noise figure. Early models of the LT-33S ran only 6 watts output and a lesser-quality GaAsFET was selected for the front end. The consequences of this were low gain and poor compression performance! The MGF1302 works much better in this regard, making the unit slightly more of a "bunny rabbit" than an "alligator" (more ears than mouth).

As on the LT-23S, a 144 MHz IF is the standard configuration, although you can special-order 28 MHz IF frequencies. The use of a 144 MHz IF allows for better filtering of the LO signal. With a 28 MHz IF, it would fall at 874 MHz and be considerably more difficult to filter out than if a 2 meter IF was used. In this case, the LO would be at 758 MHz and is easily trapped out. On-board resistors allow drive with up to 12 watts to interface with the popular multimode radios, most of which run 10 watts or have adjustable power output.

Practice shows that a lower drive level results in more linear operation. Typically, 1 to 2 watts drives the transmit mixer and the output is clean and stable. An adjustment for drive is available near the power resistors and it should be set just below the point at which the output saturates—typically in excess of 20 watts.

Performance

I used the LT-33S extensively during the ARRL January VHF Sweepstakes with a Down East Microwave 33 element loop yagi at about 45 feet. The feedline was 9913 (what else?) and no external power amplifier was used. It is certainly a challenge to work DX on a band where activity levels are low and most contacts are made with schedules. It's even more of a challenge with 20 watts, but the LT-33S came through with flying colors.

From my location in FN20, central Bucks County, 22 contacts were made in 6 different grid squares. Several were long-haul to FN42 (W1RIL) and FN32 (WA1MBA). There were many CW schedules and the LT-33S heard them all after some jockeying of the rotor box. No external preamp was used, and I'm not sure one is needed with the stock setup. Should an external amplifier be used, however, it might be worth considering.

One problem (if it could be called that) was extensive warbling of the signal (also called FMing), due to LO instability. I attribute that instability, however, to poor voltage regulation caused by too much of a voltage drop in the DC power leads from an Astron RS-7 supply. This was confirmed in on-the-air tests with K2SMN and WB2WIK, so the power leads were cut to 2 feet. The problem completely disappeared! Another cure for this condition on the LT-23S has been to re-route the coax to the final amplifier with a pair of 90 degree BNC connectors around the LO crystal. (I'm not sure why that latter problem should have existed in the first place, but the fix works 100%.)

The LT-33S was also used on the ARRL 903 Spring Sprint. Its small size and ease of switching are well suited to portable operation and grid-hopping. With a storage battery as the power source, it would be an excellent idea to disconnect the lamp from the power output meter to save on current drain. Such radios as the Yaesu FT-290R are ideally suited for portable IF stages. By using a coax switch and a small 2 meter beam, schedules can be quickly coordinated and completed.

SSB Electronics also makes a 902 transverter kit, using the UEK-3 and USM-3 modules (RX Mixer and TX Mixer). This combination uses a great deal of the circuitry from the LT-33S and the output stage is a BFQ34 running about 5 watts. The advantage of this scheme is that it allows customization of a transverter housing and antenna/DC switching.

Conclusion

The SSB Electronics LT-33S is a well-designed and engineered linear transverter for all-mode operation in the range 902–906 MHz. The front end exhibits excellent sensitivity and the power output is more than adequate for external amplifiers or straight-through operation. It is ideally suited for portable and/or contest operation, which should encourage more 902 MHz grid-hopping! 73

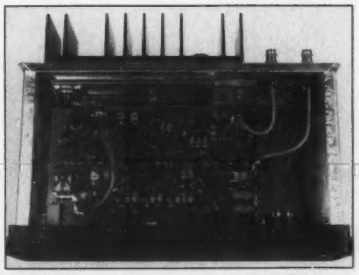
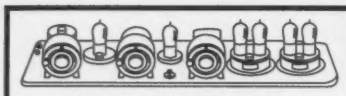


Photo B. Interior view of the LT-33S. This view looks down at the IF board. The PA is on the rear wall.



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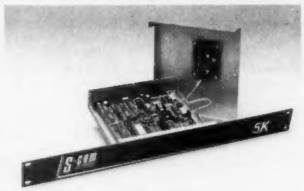

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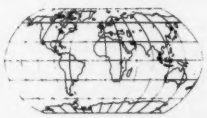

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Portable Re-entrant Cavity Two Meter Antenna

Rubber duck portability with quarter-wave performance!

by Don Morgan W7ACI

This article describes an application of Tucker's design which results in the most satisfactory two meter portable antenna this author has ever used.[1] What makes the design so attractive is that it can be easily stowed for travel, yet is a significant improvement over a duck or a quarter-wave vertical. In addition, it doesn't require radials or a ground plane. A possible disadvantage in the minds of some might be that, because tuning is required, a visual readout device is called for.

Not Much To It

This system is a half-wave vertical fed by a resonant cavity. By visualizing the radiator turned to the horizontal, and an open wire quarter-wave transmission line substituted for the cavity, and a coax feed line tapped in at the 50Ω point on the open wire line, you can see the classic Zepplin antenna design.

The cavity is simply a tin can (coffee or dog food can recommended) approximately 5–6 inches high by about 3 inches in diameter. These dimensions are much shorter than a quarter-wave, but the antenna will be capacitively loaded to resonance. After painting the outside (only) of the can a color of your choice, bore or ream the proper holes for a coax bulkhead connector. One and one-half inches up from the bottom is about right. The center rod is made from any collapsible whip which will extend to 44 or more inches. It should be attached to the bottom center of the can, either with the whip-mounting screw (some whips come with this), or by soldering it with some sort of bracket. Tucker recommends a UG-177/U hood. Whenever attempting to solder to chrome plated brass, it is best to sand off the plating first.

Before installing the whip section, mount the 50 pF capacitor (see Figure 1). We used an air variable cap, but a piston trimmer might do the job if the transmit power is very low. The cavity is a high-Q device capable of developing some surprising voltages. Don't use compression and ceramic trimmers because their configuration makes hand capacitance unavoidable while making adjustments. We designed this antenna to use with an HT—if you use more than a few watts, don't place your finger in the opening of the can while transmitting. Doing so exposes you to a zap and severely detunes the cavity. The outside is "cold" at all times.

Use an SWR bridge for initial tuneup. The three variable quantities to optimize are: the tap point of the feed, the capacitive loading, and the length of the whip. A tap point about one and one-half inches up from the bottom is the place to start. Extend the whip to 38 inches above the top of the can. While feeding RF into the cavity, tune the variable capacitor to about half mesh and watch the SWR meter drop to near zero. If it doesn't, move the tap point up or down a fraction. Once the correct tap point has been found, it will thereafter remain fixed (soldered or clamped) and the variable and whip section can be returned to pre-marked positions each time the antenna is extended for use.

I prefer, however, to retune the capacitor with some sort of readout device, such as a neon bulb or RF sniffer, because it is quite critical. A germanium diode across a 50 or 100 microammeter makes a dandy sniffer. Merely tune for maximum meter deflection (output). Again, Tucker stresses that good bonding of the capacitor rotor to the cavity is an absolute must to avoid hand capacity. A short length of coax from the cavity to the transceiver completes the job. Weighting the can or using magnets and a plastic lid are possible improvements.

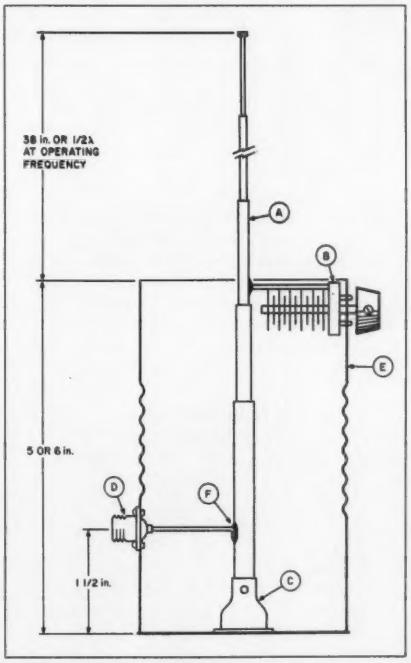

Figure 1. Configuration for the re-entrant cavity antenna. Points A–F are: whip ant., 50 pF cap., SO-239 hood, coax fitting, coffee can, tap point (clamp or solder).

Light Comparison

A low-powered handheld using a rubber duck antenna was positioned in front of a field strength meter (set at maximum sensitivity) to make the meter read exactly full scale. The distance between the duck and the meter measured 17 inches. The antenna described in the text was then substituted for the duck, and the procedure was repeated. The distance for a full scale reading increased to 27 inches. The square of the ratio of the two distances, converted to dB, is a fair indication of the "gain" of the half-wave vertical. In this case, the half-wave indicated about a 6.7 dB improvement.

If you like to build things that produce outstanding results, this project is for you. 73

Reference

1. William Tucker W4FXE, "Re-entrant Cavity Antenna For the VHF Bands," appeared in May 1981 issue of *Ham Radio Magazine* (pp. 12–25) and treats the subject in substantially greater detail.

73 Review *by Pete Putman KT2B*

W2DRZ 902 MHz Linear Transverter Module and Sequencer

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I've been saying it all along: You don't necessarily have to spend an arm and a leg to get a signal up and running on 902 MHz!

How nice to be able to substantiate that claim with the W2DRZ 902 MHz transverter, a professionally constructed unit that will take less than 1 mW of drive at 144 MHz and yield nearly 3 watts output.

Photo A shows the main transverter board, and it's a very compact layout. Note that the transverter is sold without a case. . . This saves the buyer a few bucks and allows customization when installed. But the unit is complete, requiring only 13.8 VDC, a 2 meter transceiver, and a coaxial relay to switch the antenna between transmit and receive. In addition, an external PC board serves as a power attenuator and IF post-amplifier so that 144 MHz multimodes can be used as the IF source.

Let's take a look at the lineup: The local oscillator employs a 2N5179, running at 94.75 MHz. This is then doubled to 189.5 MHz, then doubled again to 379 MHz. The output at 379 MHz is fed through a interdigital filter and doubled one last time to 758 MHz. This LO signal is taken from a second interdigital filter to knock down harmonics and is injected at about +7 dBm.

The 2 meter IF source comes in through a 10 dB resistive 50Ω pad. In theory, the user will employ the outboard attenuator board and reduce the input signal to about 10 mW at the IF input. This means only 1 mW of drive is required to drive the mixer, which is a Mini Circuits SRA-5 diode ring mixer. Being a passive diode ring mixer rather than an active type, it exhibits some conversion loss, but has high dynamic range–a typical characteristic of diode mixers.

The output is fed through a PIN diode switch array and then to a CGY21 power GaAsFET, developing about 8 dBm at 900 MHz. To minimize spurious outputs, a Toko 3 section helical filter follows the CGY21. This filter has a -3 dB bandwidth of about 15 MHz, ensuring a clean signal. Incidentally, all units come tuned for a 902 MHz center frequency, but can be easily retuned for operation higher in the band.

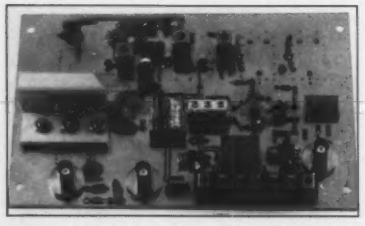

Photo A. Top view of the W2DRZ 902 MHz linear transverter. TX/RX connectors are to the left, and 144 MHz IF IN/OUT to the right.

The buffer, driver and final amplifiers are located after an on-board 50Ω relay which switches low level TX and RX signals. A second CGY21 provides about 22–25 dB gain and in turn drives an MRF557 to about 500 mW output. The final device is an MRF839, developing 2 watts across 50Ω. This latter device can actually make up to 5 watts output, but begins to compress at about 2.5 watts. W2DRZ suggests running no more than 2 watts to run a clean, linear signal.

The receive section is simple: 902 MHz signals are fed through the on-board 50Ω relay to the same CGY21 used as the first low-level amplifier, then back through the SRA-5 mixer. That's it! The manufacturer claims a 5 dB noise figure for the CGY21. As a result, W2DRZ strongly recommends a good low-noise GaAsFET ahead of the receive input, preferably with about 15 dB gain or so. But as you'll see momentarily, the power GaAsFET gives a good accounting of itself.

My initial tests with the unit were done with no chassis enclosure. This transverter doesn't seem to care where it's set up. . . the output remains constant and the receiver is quite stable. If you've had your fill of unstable LOs, or oscillating receiver sections, this will be a welcome relief! To obtain output, I initially used an HP608F Generator (with Boonton 92 to measure input levels) and a Bird 43 with a 5 watt 400–1000 MHz slug and 25 watt Termaline:

Performance Measurements

Linear Output Power

Input Level	Output Power
-10 dBm	700 mW
-7 dBm	1.5 W
-4 dBm	3.0 W
-3 dBm	3.5 W*
-2 dBm	4.0 W
-1 dBm	4.5 W
0 dBm	5.0 W**

(NOTES: *—Transverter is in compression and non-linear at 3.5 watts output.
**—Transverter heavily saturated at 5 watts output.)

As far as the receiver performance goes, I was not able to make detailed tests as my signal generator cuts off at 450 MHz, so instead I relied on over-the-air observations, specifically with the N3CX beacon on 903.080 MHz 25 miles distant. Comparisons were made against an SSB Electronics LT33S which has a sensitive front end and noise figure of under 1.5 dB.

The W2DRZ Transverter held its own very well against the LT33S, which is impressive because the front-end comparison is between a small-signal low-noise GaAsFET (MGF 1402) and a power GaAsFET (CGY21)! Based on my results, it would appear that the noise figure of the W2DRZ unit is probably closer to 2–2.5 dB and not the 5 dB claimed by the manufacturer, which was understandably done to be conservative!

A 12–15 dB GaAsFET ahead of the W2DRZ unit would probably result in a very sensitive front end with high dynamic range, as the power GaAsFET/diode mixer combination saturates at about -12 dBm input. This would result in a 1 dB compression point of about +8 dBm output, which is excellent by any standard! What this means to a 902 user is relative immunity from front-end overload by UHF TV stations or other nearby high-power RF sources, and the resultant IMD products.

Conclusions

In all, the ratings for the W2DRZ 902 MHZ transverter are quite conservative. The output of 2 watts is sufficient to drive a gain block to 20 watts, which is plenty of power for everyday work. Since the unit is linear, SSB, CW and FM modes can be used. The receiver is sensitive enough out of the box for everyday work, but a modest low-noise preamp will make a difference. The overall construction quality is excellent, and the modular system approach makes completing your 902 station a snap. It's a winner!

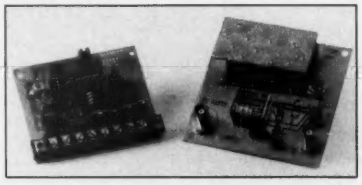

Photo B. The accessory sequencer board (left) and attenuator/postamp board (right). A 30 watt 2 meter multimode may be used as the IF.

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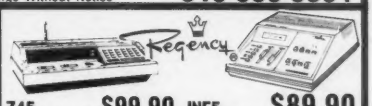

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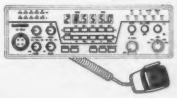

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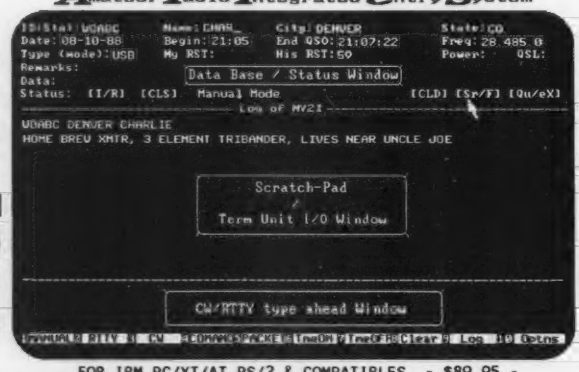

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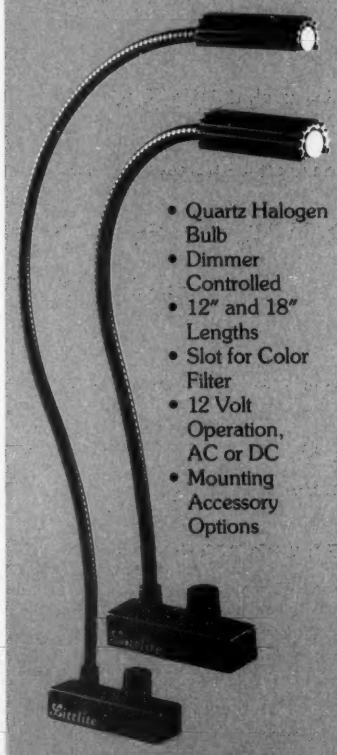

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CIRCLE 278 ON READER SERVICE CARD

The Pee Wee Thirty Transceiver

A compact 30 meter CW/AM QRP transceiver (Part II)

by Dan Eggert AC9E

After completing the assembly and powering-up of the rig, check the following list of key point receiver voltages. Use circuit ground as a reference point for these measurements. I used a 12.5 volt source to establish these following voltage values.

1. Cathode of ZD16.5V
2. Cathode of ZD26.5V
3. Pin 5 of IC13.7V
4. Pin 8 of IC17.5V
5. Pin 6 of IC211.8V
6. C41 +9.9V

Your measurements should be within 15% of these. They help spot a major construction error right off, and could save you from a lot of grief!

Next, after putting out the fires and clearing the smoke, align the IF stages. Builders with access only to a frequency counter can use the BFO as a 455 kHz signal generator. I used this simple alignment procedure on one of my rigs, and it worked very nicely.

As shown in Figure 7, remove the wire from switch S3B that comes from C24 on the circuit board, and connect it across a 10k potentiometer to ground. Connect a 0.01µF capacitor on the wiper of the potentiometer. With the BFO turned on (switch S3 to CW) and a frequency counter connected across the potentiomer, adjust T8 for 455 kHz. T8 was a fairly touchy adjustment on my rigs, so try to get it as close to 455 kHz as possible. Use the BFO's front panel control for fine tuning. You now have a crude, but adequate, signal generator with a variable output attenuator for 455 kHz!

Remove the wire from S3B that comes from the cathodes of D3 and D4 on the circuit board (again see Figure 7). Connect a 10kΩ resistor and about a 1µF capacitor in parallel from this wire to ground. Connect a voltmeter across the resistor and capacitor, and set it up to measure 1 volt DC. Remove the wire from S2 that comes from ZD1 on the circuit board to disable the local oscillators. Adjust the receiver's gain control potentiometer for maximum sensitivity.

During the IF alignment, make sure that the signal source stays on, or as close as possible to, 455 kHz. Throughout the alignment, always keep the signal generator's output at a level enough to adjust transformers' T3, T4, and T5 for a peak of about 0.75 volts on the voltmeter. It may also be necessary to lower the receiver gain during the alignment to maintain the 0.75 volt peak. With a 455 kHz signal source connected at the output of T4 (gate of Q4), adjust T5 for a peak on the meter. Move the signal source to the output of T3 (the gate of Q3), and adjust T4 for a peak on the meter. Move the signal source to the output of T2 (gate of Q2), and adjust T3 for a peak on the meter.

Repeat the alignment of T3, T4, and T5 again, but keep the signal source at the output of T2 (gate of Q2). Use the highest receiver gain setting possible, and the lowest signal source input level that is needed for a peak of 0.75 volts on the meter. Reconnect the wires previously removed from S2 and S3, and restore the circuit to its normal configuration. Check the local oscillator(s) by placing a frequency counter at the circuit connection of R4, C5, and the gate of Q2.

For the tunable version, switch the tunable oscillator on and adjust T7 for the proper front panel tuning range desired (RX frequency is 455 kHz), or just simply play around with this adjustment with an antenna connected to the rig later. Preset trimmer capacitors C13 and C14 to mid-range. With the crystal oscillator switched on, adjust T6 for the frequency of the crystal selected. The best way to align T6 is to use a scope at this test point and adjust T6 for a peak output. Builders without an RF signal generator for the receiver alignment can peak T1 and T2 while receiving a weak signal with a fairly constant signal strength. The peak in T1 is not sharp, however, and it is somewhat hard to recognize.

On one of my rigs, T2 peaked at a point where the tuning slug almost bottomed out. To avoid this, solder a very small-value capacitor across the primary of this transformer on the solder side of the circuit board if necessary to lower the tuning range.

If you didn't use the BFO as a signal source for the receiver alignment, then adjust T8 for a BFO output frequency of 455 kHz with the BFO tuning control at mid-range. If you used an RF signal generator for the receiver alignment, and a frequency counter was not obtainable, then inject a 455 kHz signal through the IF stages and adjust T8 for a zero beat when in CW mode. The receiver should now be ready to tune in the world!

Transmitter tune-up is very simple. With the rig connected to a wattmeter and dummy load, adjust the oscillator trimmer C5, and then the output trimmer C11 for maximum output power. Repeat the adjustments again for maximum output. Adjust the crystal trimmers C2 and C3 for the desired crystal output frequencies with a frequency counter, if available.

With the transceiver on a dummy load and keyed, adjust the receiver's crystal trimmers C13 and C14 so that the side tone heard in the receiver is the same with either frequency selected.

Conclusions

The rig design is basic, but most improvements would involve a lot of extra construction and redesign. My main goal was to develop an inexpensive, simple, and fun-to-operate rig.

It's quite possible to work good DX on the Pee-Wee 30—I just recently received an S-7 report from a ham on the Caribbean island of Grenada. QSOs like these are very satisfying on a QRP homebrew rig putting out only about two watts. QRPing is a joy to the ham who truly likes a challenge. Join the fun!

The component kit, including PC board, is available for $95 from Hobby Electronics, PO Box 44247, Denver, CO 80201. Ask for kit #H73001. The PC board alone is available for $35.

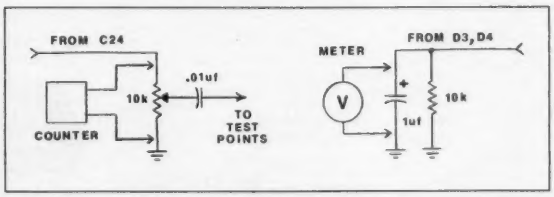

Figure 7. Frequency counter and volt meter connections to aid receiver alignment.

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CIRCLE 121 ON READER SERVICE CARD

Passions of the Ether

Hams and their reasons to be

by Steven K. Roberts N4RVE

It is a rare treat for a writer to contemplate a blank screen on the eve of deadline, trying to get in the mood and feel the audience then suddenly realize that with every reader he shares a single potent passion. Ham radio is more than a mere vertical market—it's obsession, religion, and lifestyle of choice for a diverse scattering of technoid humanity. This touches me with something approaching poignance, spawning a temporary departure from the usual theme of this series.

Actually, what started all this was a sort of introspection, the kind of analysis that accompanies any personal expenditure of man-years and kilobucks. Why am I doing this?

Growing Pains

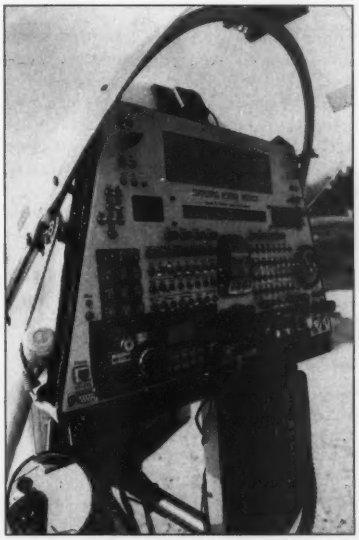
As you have probably noticed from my recent articles about the Winnebiko, my high-tech nomadness is getting out of hand. The OSCAR Mode L station is now under construction; I can operate 80–10 HF while camped and 10-6-2 FM-SSB-CW while pedaling; the bicycle-mobile packet station includes a BBS; and I'm seriously considering trying ATV with a Sony 8mm video system. Both bicycle trailers are being rebuilt with 55 watts each of additional Solarex PV modules, and I'm using Tedlar™ substrate material with a bonded shielding layer to build a dedicated pop-up operating position for the whole lightweight "shack." The 70- and 23-cm OSCAR beams break down and ride in a foam-lined drawer under the trailer, the extendable mast supports five different antennas and a preamp, and in addition to all this, there are expanded computer systems, nav/mapping systems, a voice-data-fax cellular phone with answering machine, and much more.

So what madness drives me to dedicate all available resources to a gizmological *tour de force* that, put crudely, merely lets me travel around in slow, high-risk discomfort while chatting occasionally with fellow techies?

I started pondering this question as a sort of intellectual background task last month while visiting WA4ONG in Richmond. Jim is building a new house, and we rented a U-Haul to pick up his new 170-foot Rohn 55G tower a hundred miles north at EEB. He's looking for a few hundred feet of fiber-optic cable to control an all-band IC-900 at tower-base from the house. He just set up an all-mode satellite station with the largest possible beams, another tower, and fully-automatic AZ-EL tracking and transceiver tuning under control of a dedicated PC. This same ham also operates a busy 4-port packet BBS with online CD-ROM call directory, and extends his coverage with a remote site or two. Why does he do it?

"Well, there's a bit of the anarchist in me," he said. "In fact, it irritates me to register my tower with the FAA."

As I write this, I'm visiting another Jim—AB4CZ in Norcross, Georgia. We're parked in his driveway in our temporary mother ship (a 35-foot school bus that lets us make the rounds of manufacturers, clients, hamfests, and trade shows while hustling books and working on the new bike system). I sit here keytapping in his driveway, my fingers dancing to the rhythms of Bob James, while our host pursues the passion. I see him up there clambering across the steep roof, risking his life with a sore back to replace the 3/8-wave



20-meter vertical with a new beam, dropping another run of coax along the fat bundle that already links his covenant-stretching suburban antenna farm to a room full of equipment. His bride of two weeks attempts to involve him in domestic activities, but he will have none of it this afternoon. His eyes are gleaming with radio waves. Why?

"I feel a strong pride in my ability to communicate over long distances. All my life I've really loved radio..."

Everywhere we go it's like this. Rooms papered with QSLs, relations with neighbors strained by skyhooks, budgets reeling under new gear, late nights digging through QRM in the quest for a ZA or an SU, impromptu on-air gatherings dedicated to quantifying the incremental improvement in somebody's audio hams across the land are crazy with the urge to communicate.

What Makes Radio Special?

The computer hobby was like this during its short life in the 70's, but as it matured from wire-wrapped 8008s to the epoch of software superstores, it quickly evolved from toy to tool. When I found my dear old BEHEMOTH plastered with tax charts and schedules, something happened to the thrill. Computers have become like oscilloscopes and milling machines: tools of exquisite beauty, gateways to other passions, high-tech chameleons that change color and form with a whim and a keystroke.

Perhaps the computer hobby was prevented from reaching amateur radio proportions by a device technology that packages insane complexity into untinkerable modules—a technology that either works or doesn't, offering none of the tweakings and mysterious RF tricks that we hams both love and hate.

But ah, radio. What else can span cultures, thrill us with raw power, enchant us with magic while puzzling us with complexity, challenge the intellect, satisfy the urge to compete, dazzle onlookers, serve the public, guarantee a circle of friends, reward in proportion to effort, offer security in strange places, bring out the anarchist lurking within, offer a constant flow of irresistable new toys to keep the checkbook depleted, and tie it all together with a tingling undercurrent of fun? What else could drive me to further burden an already-overloaded bicycle, something I swore I'd never do? What else could make you browse this issue of *73* and lust after boxes, Birds, and Butternuts with all the tight-chested urgency of youthful desire?

Go on, admit it. You concoct elaborate justifications, but your purchases and projects are based on passion.

OK. Let's pin it down. What kind of passion? The more I travel among hams, the more I see a discrete set of motives lying behind the mad pursuit of signals through the ether. How many of these basic ham-types apply to YOU?

The Anarchist

In these days of insane politics, candidates of dubious motives, terrorists, scattered mini-wars, and earnest discussions of mad Star Wars pursuits, it is tempting to dedicate energy to the elimination (or at least the avoidance) of governments. Forget your nationalism for a moment and join me in a quick fantasy....

We're cruising the Galaxy in a starship, and broad-spectrum electromagnetic activity with a higher-than-normal autocorrelation function suggests life on a blue-green planet.

Discreetly we hover, all sensors on. Initial conclusion: a single intertwined ecosystem, dominated by a single intelligent species.

Looking closer and extracting meaning from the jumble of transmissions, however, we begin to observe that the planet is crisscrossed with boundaries, some following natural geographic features, others imaginary. Different abstract regions, populated by the same species, spend 10–20% of every individual's income on the tools of warfare. Humans crossing imaginary lines can be harrassed, searched, taxed, imprisoned, or killed. Artificial trade restrictions exist, raising the overhead of living.

Radio waves have no respect for borders. When they are wielded by humans who feel likewise, the result is a refreshing sense of freedom from the artificial constraints of governmental policy. Even though an American ham can't ask an Irish ham to call a friend in Dublin, the capability is there; even though there are places where ham radios are considered spy equipment, it's good to know that if it all hits the fan, we amateurs will be there to help knit humans together. Every new station, be it a packet BBS or a 1.2 Gig HT, adds to the general ability of our species to keep itself from dissolution.

The Survivalist

Closely related to the Anarchist is the Survivalist, but the motives are more personal, less related to politics than preparedness. We have recently seen the effects of massive single-point failure in communication systems, when that switch in Illinois crashed and left thousands without information links.

There is genuine satisfaction in owning equipment that will work when commercial services are shut down by disaster, war, or economic collapse. This is one of the pleasures of my bicycle, in fact. Not only does all the equipment run on solar power, but so does the bike itself. The personal effect of an American information/power/fuel disaster would be softened by the presence of radio systems that keep right on working under natural power, assuming that no NEMP has come along to blow away all my chips.

The World Citizen

Culturally, ham radio can be described as a global door-opener. Peace and understanding among various aggregates of Earth's citizens depend more on communication than anything else (something fully realized by totalitarian leaders who do their best to prevent it). We have been conditioned to believe that difference means danger, that at any level of magnification, world affairs reduce to a paranoid "US versus THEM" formula.

Politics aside, the easiest way to fix this illness is to simply communicate (interactively, not just by watching the occasional PBS documentary about the rituals of Zambian natives or Russian holiday fashions). Hams are in a unique position to spread a demystifying awareness among their fellow citizens—spending hours in relaxed conversation with new friends worldwide, they realize that they're not all that different.

Talk to aliens beyond the QTH and signal-report level. Discover that they're not aliens after all. Share those insights with ethnocentric Americans, and realize that you're helping save the world.

The Social Animal

Of course, not all hams want to think globally. There's nothing intrinsic to a radio that forces its user's mind to open. That's OK—there are plenty of other good reasons to do this.

Consider the neighborhood. If yours is like the ones I knew before moving to a bicycle, it is a random assemblage of not-necessarily compatible people cast together by economic strata and chance. The contrasts can be absurd. Both Jims mentioned earlier are harrassed at some level by their neighbors for antennas and unsightly visiting nomad buses, while the neighbors' goal in life is a perfectly manicured lawn and a clean Cadillac.

This seems a strange way to live—to be cast into physical proximity with those of incompatible natures. It's one of the driving forces behind my continued wandering. I prowl the land in search of exceptions.

The social ham, like the computer networker, has discovered a solution to the problem. When you go on the air, your neighborhood becomes virtual, whether the scale is global or repeater-wide. Your contact is brain-to-brain (not face-to-face), and the effects are interesting. First, when it doesn't matter what your friends look like, you can make some astonishing connections. Second, when their location is no more important than their alma mater, your relationships are not constrained by geography. From the folksy Possum-Trot net to the Sunday morning meetings of old friends on 40 meters, hams have found ways to step outside the boundaries of their physical neighborhoods.

This has led me to make my home in Dataspace, a not-land where bigotry is obsolete and geography falls apart. Hams have known this for decades, and often see the physical reality of suburbia as an insignificant backdrop for their real life, instead of the mind-numbing trap that it can so easily become.

The Socially-Inhibited

Then there's the other side of the same issue. Some people don't have a choice. They are shunned. Perhaps scar tissue or deformity makes them hard for style-conscious Americans to face. Perhaps they're fat, ugly, or confined to a wheelchair. Maybe their speech is made tortuous by cerebral palsy or stuttering. Maybe they're a minority race in the wrong part of town—or female and technobrilliant in a culture that frowns on that tendency in "girls."

The point is, ham radio can open communications channels while hiding whatever it is that makes normal socializing difficult. While anonymity can be abused (especially in the computer networks), it can save the very lives of those driven into desperate loneliness by their appearance.

There's a brain in every body, even if the face doesn't meet current standards or the peripherals don't all work. If you know someone like this, dying slowly of intellectual neglect, take the time to demonstrate ham radio. You may make a life worth living....

The Public Servant

I've always been fascinated by this much-publicized aspect of ham radio. Individuals build communication systems on behalf of society, out of pocket, without pay, often taking time off from work when volunteer radio duty calls. It takes a variety of forms, ranging from building packet mail-forwarding systems to manning a disaster-relief nerve center, and the motives behind it are among the most noble of any in our culture. There really are people whose need to help other people, even strangers, is a major personal priority.

Actually, there are two forces at work here. One is the humanitarian support of those in trouble (or practice for real emergencies by helping at public events), and the other is the creation of systems that keep communication flowing without cost or corporate substrate. The former is easy to undersand, but the latter is not so obvious.

What, exactly, drives a ham to spend thousands of dollars to bring a new packet BBS online? I think we'll find that it spans most of the other motives in this article, from being the biggest digital signal on the block, to the seductive delights of technology, to the hope that all our communication eggs don't end up in an expensive and volatile government basket. When you consider the cost of such a station can run $10,000 or more, the power of the motives behind it becomes obvious.

And what about AMSAT? The packet satellites going up next January will be cheap at about $40,000 each, and the OSCAR 13 system just launched has been estimated at roughly $2 million. This not casual tinkering, folks, this is passion.

The Good Samaritan

Of course, there are thousands of low-budget hams who live far from the big projects. They never participate in emergency preparedness exercises, and may even grumble when their favorite repeater is tied up all day by logistical support for a 10K run.

But these same folks would elbow each other aside in the rush to help a stranded motorist or call the police about a drunk driver. Whether it's our familiar need to help our fellow man, or a less-noble desire to justify the money spent on radios, may be hard to tell, but the net effect is an ad hoc cadre of concerned citizens with radios.

I have felt deep satisfaction in stopping my bike to help stranded motorists, and though I am of little use for towing or jump-starting, I can sure do something about calling for help.

Perhaps this sort of thing also exonerates us a bit, making our obsession with new toys seem a bit less selfish....

The Sportsman

And then there's the scoring culture. For many hams, DX contacts are not so much cultural interconnections as fodder for the

coveted "Worked More Than 100 Countries on Less Than 33 Watts While Eating Burritos in the Snow" award. These contacts have a formula look about them, and there have been rumors of robot contest ops that compete effectively.

Some people run contests for the glory. Others for the exercise. Others for a concentrated dose of that enchantment that comes with working every new state or country (I ran about 150 QSOs on Field Day as a casual one-delta for this reason). Some do it to receive external, objective feedback on the effectiveness of their station. And still others do it to add excitement to the process of advancing the state of the art in communication techniques (collecting meteor-scatter grid squares).

As with most aspects of ham radio, the question of motive is mired in complexity. Clearly, there is thrill in competition, and some of the more sophisticated forms of "radiosport" reward not the bucks spent on big guns, but the hours spent on fine-tuning receive efficiency and operating skills.

The Showoff

But some people have no such motives—or if they do, they're secondary to the feeding of an overgrown ego. You meet them occasionally on the air; it seems that every club has one. Outlandish claims of technical derring-do are always afloat when this bozo is around, and be careful lest you become drawn unwillingly into a battle of one-upmanship.

Ham radio can be appealing to the egotist, for a new audience is only a CQ away and verification of lies is next to impossible. This kind of person cannot survive in a closed community, and so turns to short-term relationships to feed the habit of trying to impress everyone. And with the full range of this complex hobby available as fodder for invented experiences, he can get away with it for quite a while before other hams start experiencing mysterious local QRM after being dragged into a QSO with him.

The Practical Ham

This one's easy, and also common. There are four ways to stay in touch with the world from your car: cellular phone, CB, business radio, and ham radio. The first is expensive and non-social, but very reliable and quiet near cities; the second is culturally useless, but occasionally handy on the Interstate; the third involves business licensing and expensive hardware; the fourth is easy, fun, reliable, and affordable. I have met a number of hams who got their license only for the ability to autopatch home every afternoon and say, "Honey, I'm on the way. Need anything?"

Maggie KA8ZYW joined me electronically as a condition of the high-tech nomad job. Getting there was a big challenge for one whose life had been spent far removed from technology, but she did it, and it has not only kept us in constant contact, but has nearly doubled our range of on-the-road relationships. Ain't technology wonderful?

I would broaden this category to include safety. I have often pedaled into the ragged end of an unfamiliar city, paused by the road to store all the local repeaters in memory, then pressed on with the reassurance of an occasional reset beep in response to my left thumb.

And for some people, ham radio is all that's available. In the wilds of Nevada, there are whole communities without telephones that are linked together via a mountaintop repeater and local hams.

The System-Beater

Any comparison between ham radio and other communication links brings up another point. Some hams have discovered that routine personal long distance conversation is free via radio and expensive via phone. That sounds like a good stand alone reason for getting a license, even if you're not interested in socializing or exploring the technology.

The Tinkerer

Ah, the urge. Tinkering goes with radio the way clambering goes with mountains. The combination of the latest magazines and a robust junkbox is seductive and irresistable. The acrid smells of solder and silicone, the warm convective flow that spells victory in the smoke test, the probing touch of meter and scope. Graticules in the night. Dragging a clip lead from the clutter of your bench, shaking off a litter of excised caps and unnameable bits of electronic detritus from past projects. Stepping barefoot with a shout on an upended DIP. Ripping open padded bags from mailorder parts houses. Poring through flea market bins, your mind a confusion of possibilities locked in mortal conflict with economic reality. Hauling your new widget-framus over to a friend's house to use the signal generator. Making the HW-8 better. It never ends, and never should. This is ham radio's essential nature, and may there never be a day when we all become appliance-ops!

The Gadget Freak

But there's another side to the love of hardware. Did you sit in the numbing torpor of grade school, keeping awake during the drone of history class by drawing magnificent pictures of your future laboratory?

Do you thrill to the IC-781, reach across hamfest vendor tables to feel the dials, and imagine your house bristling with log periodics, discones, rhombics, and helices? Do you periodically clean up the shack (especially upon receiving a new piece of equipment), then sit back and gaze at it all in a sort of marveling fog?

If so, you're a gadget freak. You want all new electronic toys, and find their acquisition at least as exciting as their use.

The Magician

Early in this series, I related an event that took place during one of my first forays into HF QRP. I spoke of the sliced rock in the Virginia sunshine that pumped current into a box of chemicals, conjuring a few Megahertz of RF modulated by my wiggling fingers and shoved out to a wire in the trees. Across the ocean, 6000 miles away, a stranger heard the disturbance in the ether and responded. Soon we were becoming friends through something best described as magic.

Despite Maxwell's equations and the sciences of propagation and antenna design, there is something arcane and wonderful about radio. Computers work with digital perfection, cars run as long as you keep 'em oiled, but radio waves behave on the whims of sunspots, meteor trails, ionospheres and tropospheres. You can never know everything about it, and thus there are always surprises and confusions, wonders and delights. Hopping around the globe through a little box on your desk, hearing exotic places calling from deep within a tangled spectrum of voices and carriers . this is something as much in the blood of radio as the triode-burned fingertip and the dittybop of code practice. And now we have EME, and OSCAR, and much more to keep our eyes wide with wonder as we refine our skills and peel away the obscuring mysteries.

The Explorer

For the scientist, of course, all this translates into invention and discovery. How much effective bandwidth can be crammed into a 5 kHz channel, anyway? Will a lot of spread-spectrum stations raise the noise floor? Which is better, a lot of directors or a phased array?

How can the packet network become interwoven so deeply that it becomes self-maintaining and invisible to the users? Can you predict tropospheric ducting? Ham radio can keep you exploring for a lifetime, even if you couldn't care less about today's WX in EA8-land.

The Teacher

For decades, of course, ham radio has had a life of its own. It has become populated by people of such diverse motives that it is increasingly hard to make generalizations.

But some hams, in love with the spirit of the hobby, dedicate themselves to keeping it fueled with new blood. School programs, video tapes, Elmerizing ... all this reminds me of Bradbury's *Fahrenheit 451* in which people "became" their favorite books so that literature wouldn't die under a repressive regime. Keeping the spirit alive is a tradition in ham radio, and has a lot to do with preventing the median age from advancing even faster than it does.

And so there we have it. A marathon overview of the motives that drive otherwise sane people to fling themselves into the ham radio passion. How many of these "types" did you recognize in yourself? I am a blend of twelve of them, and I'm sure that's not at all unusual.

Whatever your motives, please share them with others. Keep ham radio thriving in all possible ways. And if you happen to see a couple of loonies pedaling their stations past your QTH, invite 'em in for a beer. Cheers and 73's from the road!!! 73

Antenna Systems—Part 2

W3ZC continues to dispel popular antenna system misconceptions.

by John Lawson W3ZC

In Part 1 (September 1988 *73*), I stated the ideal of a matched antenna system—that antenna, transmission line, and transmitter output impedances are all 50Ω. This, however, is not usually the case. Amateurs are not single frequency operators, and we know that antenna impedance changes with frequency of operation. How to match (or come reasonably close to matching) impedances?

Assume you have a beam and you want to feed it with 50Ω RG-8/U coax. There are several factors to take into account. First, coax is unbalanced transmission line—almost all the current travels in the inner conductor, with very little, if any, in the shield. Second, the driven element of a beam is much like a dipole. It is a balanced antenna. It expects equal currents to flow on each side of the feed point. With directors and reflectors, it has an impedance of around 15Ω (dependent primarily on the element spacing). The problems therefore are to change from an unbalanced to a balanced configuration, and to match the beam impedance of 15Ω with the coax impedance of 50Ω.

Balun

One way to do both of these tasks is with a balun (contraction for "balanced-to-unbalanced.") This is really a transformer with a ferrite core.

A 4:1 balun does both jobs. The problem with a balun is that, at the band edges, especially with a wide spaced beam, the mismatch is high, causing the ferrite core to heat up if you're running considerable power. There are also environmental considerations with a balun. The balun core can corrode, changing its characteristics.

Most hams get around this by using a coil of coax, in which the shield acts as a matching stub and performs the impedance transformation. This configuration is almost entirely reactive and consumes very little power even at the band edges where mismatches are usually greater. There may be a space problem regarding where to place this coil of coax, but up on the tower it's usually out of the way.

Antenna Gain

This term tends to confuse people, because it implies an increase in total energy after going though a given antenna system. What gain really is, however, is a ratio between the strengths of *useful* radiation patterns of two antennas. These two antennas are the reference antenna, and the antenna to compare to the reference, both with the same input energy. The units are usually given in decibels, or dB. Note that the "gain" that we see is merely a redistribution, or rearrangement, of the supplied energy. The more the supplied energy is concentrated into the useful radiation patterns, the more gain that antenna has.

In HF antennas, a common standard of comparison is the isotropic radiator. This is a hypothetical antenna that radiates equally well in all directions. Another common reference antenna is a half-wave dipole in free space, which has a little over 2 dB gain, in reference to an isotropic radiator. Its pattern appears from the top view as a pair of opposing ellipses, both emanating from the feed point. As viewed from the end, the pattern is circular. Some of the pattern energy is not useful—for example, the portion of the field that radiates straight up or straight down is usually wasted. Antenna engineers can design systems that take this unusable energy and redistribute it into the side lobes, thus increasing the field intensity of the side lobes.

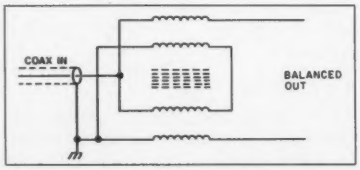


Figure 12. Typical balun used to isolate a grounded source from a load (antenna).

Beams and parabolic reflectors take this "concentrating" further. Instead of a bidirectional pattern, as with a dipole, they focus the available energy into a single direction, attaining larger, more directive, gains.

A word of caution. Advertisers' antenna gain figures often don't tell the whole story—they often don't give the reference antenna. When you read about an antenna having a given gain, you don't know whether it's in reference to an isotropic antenna, a half-wave dipole in free space, or some other reference. Manufacturers use different standards. Always ask "the gain over what?"

Wrapping Up

The following statements sum up this two part series.

1. In any antenna system consisting of carefully selected quality components, don't bother trying to get the SWR below 2:1. Any further work to reduce an SWR of 2:1 on any coaxial line will be completely wasted from the standpoint of increasing power transfer significantly.
2. Low SWR alone is not proof of a good quality antenna system, or that it is working efficiently. Low SWR with a suspicious antenna can indicate that something else is wrong.
3. SWR in the antenna system is determined *only* by the matching condition at the antenna, and is *not* changed or brought down by any matching device, such as a Transmatch, installed at the input end of the transmission line. Low SWR obtained by using a matching device at the input indicates that the output of the transmitter and the input to the antenna *system* are matched and that maximum power

will be transferred. The SWR between the feedline and the antenna remains unchanged.

4. Adjusting any matching device placed at the input of the transmission line, such as Transmatch, L match, T match, or the transmitter output tuning, for maximum transmission line current creates a perfect mirror or conjugate termination for the reflected wave. The reflected wave, therefore, is totally re-reflected upon arrival at the transmission line input. The tuner gives the proper mismatch cancelling reactance to effect this action. The reflected wave is re-reflected **in phase** with the transmitter output wave, the sum of which constitutes the incident power.

"Low SWR alone is not proof of a good quality antenna system."

5. If a suitable matching device (such as a Transmatch) cancels all of the reactance developed by a non-resonant length radiator and a random length feedline which is mismatched at the antenna feed point, the antenna system is resonant, the mismatch effect is cancelled, maximum current flows in the radiator, and all real power available at the feed point is absorbed by the radiator.

A. The radiator of an antenna system need *not* be of self-resonant length for maximum resonant current flow.

B. The transmission line length need *not* be any particular length.

C. A substantial mismatch at the transmission line antenna junction will *not* prevent the radiator from absorbing *all* real power available at the junction.

6. Reflected power does not represent lost power over that which exists in a matched situation, except for an increase in transmission line attenuation losses. In a loss-less transmission line, no power is lost because of reflection. Only when the matched line attenuation and the SWR are both high is there significant power lost from reflection. On HF bands using low-loss cable, reflected power loss is generally insignificant. At VHF, however, it becomes significant, and at UHF and higher, it is critical.

7. Total re-reflection of the reflected power at the transmission line input is the reason for its *not* being dissipated in the transmitter. It is conserved rather than lost.

8. Reflected power does *not* flow back into the transmitter and cause dissipation and other damage. Damage blamed on reflections is really caused by improper output coupling—not by SWR. Tube overheating is caused by overcoupling, mistuned loading, or both. Tank coil heating and arc-overs result from a rise in loaded Q, caused by undercoupling. With manipulation and/or the addition of a matching device (such as a Transmatch), proper output coupling can be attained no matter how high the SWR. The transmitter doesn't "see" SWR at all. It sees an impedance resulting from an SWR.

9. Both coax and open wire feeders can radiate, though *not* to any significant level, by re-radiating energy coupled from the antenna due to feeder positioning, or by feeding a balanced antenna with unbalanced transmission line. Transmission line radiation has *no* relationship to the level of SWR.

10. Lowest feedline SWR occurs at the self-resonant frequency of the radiating element it feeds, *independent* of feedline length.

11. SWR *cannot* be adjusted or controlled in any practical manner by varying the transmission line length.

12. SWR indicators need *not* be placed at the feedline/antenna junction to obtain a more accurate measurement. The accuracy limits of the common SWR meters indicate that SWR at any point in the antenna system may be determined by simple calculation involving the SWR at the point of measurement, the transmission line attenuation per unit length, and the distance from the measured point to the desired point.

13. If the SWR readings change significantly when moving the SWR meter a few feet one way or the other, it indicates that some other problem exists and *not* that the SWR is varying with line length. The SWR bridge need *not* be placed at half-wave intervals to obtain a correct reading.

14. A dipole cut to be self-resonant at 3.75 MHz and fed with either RG 8/U or RG 11/U will not radiate significantly more at 3.75 MHz than at 3.5 or 4.0 MHz for feeder lengths up to 200 feet, providing proper loading can be attained.

15. With the use of a Transmatch or a simple L or T network at the line input, proper coupling can be attained over the entire band with *any* random length coax.

16. Changing the height of a dipole above ground or lowering the ends of a horizontal dipole to make an inverted V will have an insignificant effect on the amount of power reaching the antenna from the standpoint of attempting to reduce the transmission line loss due to SWR.

That's it! I hope this has been an elucidating series on antenna system impedances and how to match them. 73

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Microwave Test Equipment for 10 GHz

Several ways to use the detector mount

by C. L. Houghton WB6IGP

This article describes some of the test equipment which members of the San Diego Microwave Group use to make mountain-topping more enjoyable. The 10 GHz detector mount and its many uses are central to this project. You may be quite surprised by the variety of uses we came up with, and still more wait for your discovery!

I describe a detector amplifier that improves the operation of a remote coupled wavemeter for frequency tests and measurements. In a later article, I will cover the use of a backfire antenna detector, antenna bore sight indicator, and a method of injecting a two meter handheld into a 10 GHz transceiver and copying it, which allows for very accurate frequency measurements on 10 GHz.

The 10 GHz Detector Mount

The detector mount, the backbone of this project, is made from a short piece of 16 series waveguide measuring ½″ by 1″ on the outside, and 0.4″ by 0.9″ on the inside of the guide. You need only a short section of waveguide for each detector mount, which you can make quite easily from a discarded piece of waveguide (make sure it has flanges attached). This could be part of an attenuator assembly. You can build the flanges on each end of the attenuator into two detector mounts. Ease of construction depends on what you can find in surplus.

If the piece of waveguide you obtain is longer, you could place a three-screw tuner just ahead of the flange before the detector diode. This can tune out mismatches, thus improving mount efficiency. My mounts didn't need this, but yours may. The mount with a slide screw tuner would make a fine detector for your 10 GHz microwave receiver. This type of detector is normally used with a waveguide circulator or a polaplexer type of transceiver system. (See the article, "10 Gigahertz Polaplexer," in this issue.)

Detector Mount Construction

I cut off the section of WG-16 with a hacksaw, leaving a single flange and attached waveguide about 1¼″ to 1½″ long, then fit the waveguide with a piece of brass about 0.125″ thick, the holder for the ground end of the 1N23 diode. Solder this piece of brass to the bottom of your waveguide (the 1″ wide side), flush with the back end of the guide. File the back end of the guide flat and check with a carpenter's square to make it's true and flat. Spilt solder in the guide is quite lossy, and should be filed away.

Now drill a hole into the top and bottom piece of the guide through the brass stock you soldered on. This hole must be small, so use a 1/16″ drill bit. Chuck the bit up in your drill so as to have just enough extending to go through both top and bottom in one motion, without the drill wobbling or going off true. This pilot hole is centered ¼-guide wavelength from the rear of the guide end opposite the flange. For 10.2 GHz, the ¼-guide wavelength is 0.378," 10.3 GHz is 0.371," and 10.4 GHz is 0.366." This is measured from the back end of the open waveguide to dead center in the waveguide face (on the 1″ side). See Figure 1 for details.

The bottom end of the mount is drilled out to 15/64 and then opened up to accommodate a tight fit for the 1N23 diode. Do not go too fast or make the hole too large—a tight fit is necessary for a good ground connection. Drill out the top hole (now 1/16) to open it up for the top of the 1N23 diodes pin. I used a 7/64″ bit. Open it up a little if you need to. Tap the diode with a 3-56 thread, or any thread on hand that will fit the top pin of the diode. Short the diode during this operation to prevent destruction from static discharges. Tin foil works well.

When a few threads have been cut, clean the device and place a small mica washer just under 1/4″ in diameter over the top of the diode's pin. Next, insulate the pin. Cut a piece of Scotch tape and place it on a piece of glass, then trim your final section 0.080″ wide, just long enough to go around the pin once. When the tape is in place, it will serve as a centering collar and insulate the pin from the top of the waveguide mount.

Fit the top part of the diode that extends from the waveguide, with a second mica washer, and place a small brass washer and ground clip with the nut to secure the entire assembly. Inspect the inside dimensions and remove any burrs that might have crept in to the operation, and which could possibly short out the diode and pierce the mica washers. I therefore recommend polishing with 400 grit

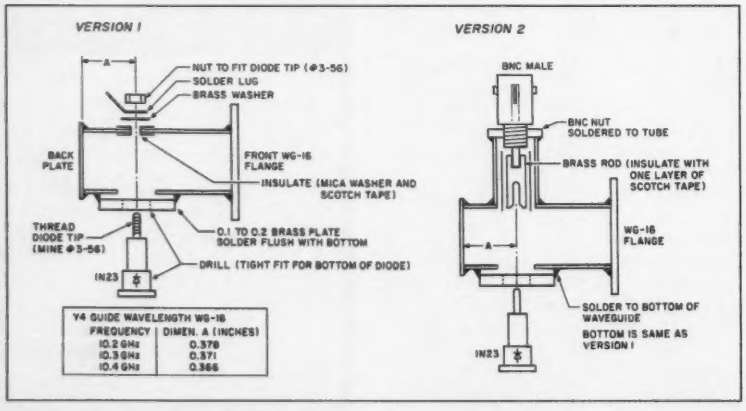
VERSION 1
VERSION 2
A
NUT TO FIT DIODE TIP (#3-56)
SOLDER LUG
BRASS WASHER
BACK PLATE
FRONT WG-16 FLANGE
INSULATE (MICA WASHER AND SCOTCH TAPE)
THREAD DIODE TIP (MINE #3-56)
0.1 TO 0.2 BRASS PLATE SOLDER FLUSH WITH BOTTOM
DRILL (TIGHT FIT FOR BOTTOM OF DIODE)
1N23
BNC MALE
BNC NUT SOLDERED TO TUBE
BRASS ROD (INSULATE WITH ONE LAYER OF SCOTCH TAPE)
WG-16 FLANGE
SOLDER TO BOTTOM OF WAVEGUIDE
BOTTOM IS SAME AS VERSION 1
1N23
¼ GUIDE WAVELENGTH WG-16
FREQUENCY | DIMEN. A (INCHES)
10.2 GHz | 0.378
10.3 GHz | 0.371
10.4 GHz | 0.366

Figure 1. Two versions of the detector mount construction.

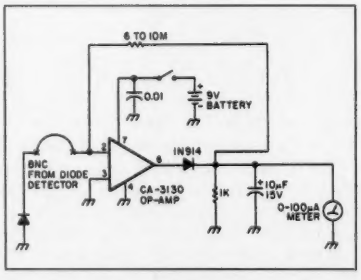

Figure 2. Detector amplifier schematic.

paper. If you are satisfied with the mount, remove all parts and solder a back plate on (with the diode removed).

When soldering, place the unit on the end plate and insert a small moist piece of paper towel to hold the side plate and prevent the solder from melting. Use a small amount of solder to attach the end plate. Keep heat to a minimum to prevent solder from flowing inside in the guide. Remove all excess solder and rosin, clean with alcohol, and assemble the diode on the mount itself.

You can make a mount as above, but with a different top section. It's a tricky soldering job, however. Drill a large hole in the top previously used for the top pin of the diode and fit in a short section of brass tube, which you then solder to the top of the waveguide. Next, you attach a BNC nut to the top of the tube and solder it firmly in place. Attach a short piece of brass rod, drilled to accept the BNC center pin on one end and the 1N23 diode tip on the other. When the assembly is insulated with a layer of Scotch tape, and inserted into the brass rod with the BNC nut attached, it will make contact and complete the mount. You will have to adjust the bottom spacer and the length of the brass tube so that the 1N23 diode pin makes contact with the brass rod that has been drilled to accept the 1N23 diode's pin. The rod should be nearly flush with the top of the waveguide. See Photo A for the pre-assembly and Photo B for the finished detector mount.

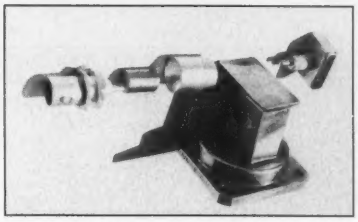

Photo A. Pre-assembly of detector mount with modified top section. Brass tube is soldered over the large hole on top of the waveguide. BNC nut is then soldered to the top of the brass tube.

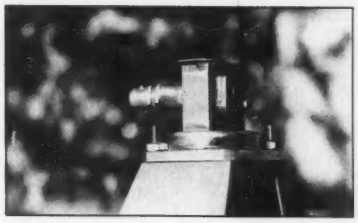

Photo B. Fully assembled detector mount showing countersunk diode.

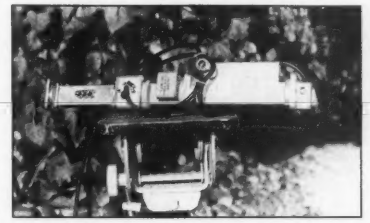

Photo C. 20 dB directional coupler CG-176 mounted between my Gunn oscillator and magnetic isolator. Forward (left) is the detector mount and the three-screw matching network.

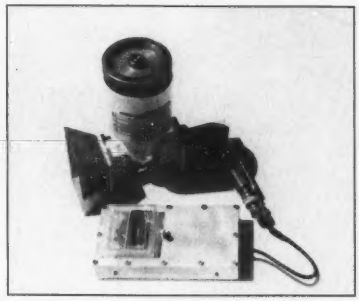

Photo D. Completed amplifier in metal box connected to wavemeter (FXR) with a very short coax cable.

Detector Mount Testing

When the detector mount is finished, check the diode with an ohmmeter for front-to-back ratio. Use the times 10 scale, since most diodes show about 5k reverse and 100 ohms forward. *Do not use the times 1 scale, because on some meters too much current can destroy or damage the diode.*

When you are ready to use the finished detector mount, connect a 100-microamp meter to the diode clip and ground, and turn on the Gunn diode oscillator. Hold the detector mount one or two feet from the antenna. You should have a reading on the meter showing relative power received. You can use the detector as a field strength meter to tune the Gunn oscillator and antenna to best match. By coupling a small horn antenna to the front of the diode mount, you can move further away and see the strength and pattern of your system. This is, in effect, a mini antenna test range. Credit for the detector mount with the threaded diode goes to the very fine *RSGB VHF/UHF Handbook*.

Detector Amplifier

By attaching a simple amplifier to the detector, and coupling an absorption wavemeter with a small horn antenna, you can go further away from your source and make frequency measurements. The detector and wavemeter has to be coupled very tightly to see the slight dip in power from the absorption wavemeter.

The amplifier was very useful in remote operation to check our frequency. Without it, we had to insert the wavemeter into the feed of our Gunn oscillator, which doubtless upset our measurements from the loading on the oscillator, large magnetic isolators notwithstanding. The amplifier on the wavemeter skirted this problem by allowing operation at some distance in front of, and just to the side of, the main lobe of the antenna. This made our frequency readings a bit more accurate.

Amp construction is straightforward. It is a simple single-stage current amplifier and peak detector rolled into one op amp. You can use the amplifier with either a commercial or the above home-brew detector mount with good results. The circuit was designed by my partner, Kerry Banke N6IZW, who selected the RCA CA-3130 because of its ability to work from a single 9 volt transistor radio battery. It works quite well. See Figure 2 for the circuit diagram.

Amp Operation

Enclose the entire amplifier and connecting cable in a tight RF-proof enclosure. This unit will be used on some high peaks where there may be much high power commercial operation. The RFI will influence your test equipment and can cause severe overloading to some two meter radios.

You can also enclose the entire back end of the detector mount in a small shielded box. This provides the best shielding.

Wavemeter Variations

We tried two variations of wavemeter setups, and each had advantages over the other. For the first, we attached a small horn antenna to one side of the wavemeter, and the detector mount to the other end. I then coupled the amplifier to the detector mount which allowed me to move about the front side of the dish antenna and obtain an on-scale reading without loading on the Gunn oscillator. With the higher meter reading, the dip at resonance with the wavemeter was now very easy to read and we could easily and confidently adjust our frequency on remote field outings. See Photo D, which shows the wavemeter and amplifier I use for remote readings.

The second method uses a 20 dB directional coupler inserted between the Gunn oscillator and the antenna, in front of the detector mount for the receiver. I bought the coupler, labelled CG-176-A, from a local surplus dealer for $7.50. The wavemeter, with horn removed, is fitted with a coax-to-waveguide adapter and connected to type "N" connecter on the coupler. Using the coupler, I can conveniently make frequency adjustments from the back of my dish. (See Photo C, Directional Coupler). This is much safer, since 150 mW of microwave energy going to a 30″ dish giving 30 or so dB gain can cause bodily damage, especially to the eyes. BE CAREFUL!

Future Goodies

In a second article (to appear in *73* at a future date), I describe in detail the Backfire Antenna and the two meter injector. The two meter injector lets you set a frequency accurately by coupling an HT to your 10 GHz receiver.

I will make available high power Gunn diodes, case style 118 with silver brass rivets operating at 10 GHz, with measured power output of 50–100 mW, for $5 each, postpaid continental US. There are select, higher power devices available for 6 GHz, 10 GHz, and 18 GHz. (Power output varies from one cavity design to another.) I will gladly answer any questions regarding this or related projects. Please enclose an SASE for prompt reply. 73

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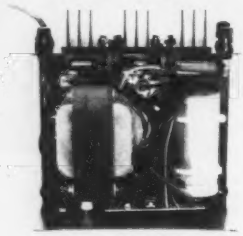

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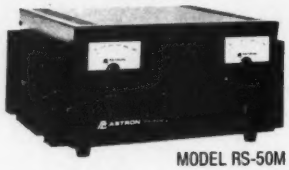

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• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

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VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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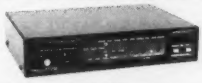

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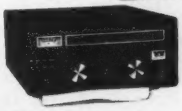

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CIRCLE 41 ON READER SERVICE CARD

73 Review by Pete Putman KT2B

Down East Microwave Model 2345LY

45 Element 23 cm Loop Yagi

Down East Microwave
Box 2310, RR #1
Troy, ME 04987
(207) 948-3741
Price Class: 2345LYK 23 cm Loop Yagi Kit: $82.00
2345LY Assembled and Tested: $99.00

The 23 centimeter band (1240–1300 MHz) is fast becoming the most accessible of the amateur microwave allocations, mainly due to the wide range of commercially-made equipment available. This includes several different antenna designs from both foreign and US manufacturers, ranging from loaded mobile/base whips, to "long-boom" designs for weak signal (SSB/CW) and ATV work.

The Down East Microwave 2345LY falls into the latter category, using 45 full-wave loop elements on a 15 wavelength boom to achieve nearly 20 dBi gain. The design is based on the classic loop yagi pioneered by G3JVL many years ago, and loop yagis have found wide acceptance from 903 to 3456 MHz since. Down East's literature claims that "...four 23 cm 45 element 'loopers' compare favorably in gain to a 7-foot dish, with much less wind resistance." Not only that, but four loop yagis are considerably easier to install on a frame and use with a rotator than a dish.

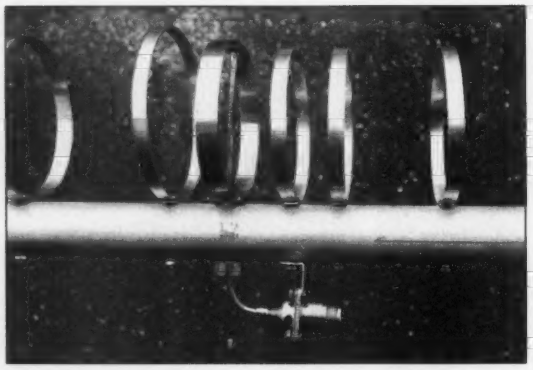

Photo A. This view shows how the driven element is fed, using UT-141 rigid coax line. The loop is a full wave at 23 cm. Input impedance is 50Ω.

Check Out The Parts

I selected the "K" (kit) version for this review. 2345LY construction is quite simple, although there are several bags of parts to contend with. I suggest you first sort all of the hardware into four or five piles. Down East ships a small package of 4-40 stainless screws, lockwashers, and nuts that are used to secure all 45 elements to the boom. Sort these into three piles for quicker assembly. 8-32 nuts, lockwashers, and bolts are also included for the boom-to-mast clamp assembly, and these can be set to one side.

Assembly

Only one tool is really needed for 95% of the assembly work. Use either a ¼" wrench, or, better yet, a ¼" socket drive/spintite. There are 7 sealed bags containing like elements, and each is clearly labelled. Don't open the next bag until you are finished with the prior one, otherwise you may mix up the parts, causing great confusion! The differences in circumference between element #D23 and #D24 is just 0.101 inches, so a mistake there would be hard to find and correct.

It's best to install the elements from the rear forward. The lockwashers allow quick tightening, but make sure the ends of each loop don't flex inward or outward. Holding the loop while spinning the socket drive will prevent this. Tighten the loops as snugly as possible to avoid misalignment from light bumps or incidental contacts as the antenna is installed.

As with all Down East loop designs, two reflectors are used. Unlike the 33 cm and 13 cm versions (reviewed earlier this year), the two are of different width aluminum stock. The driven element is fashioned from brass strip and tubing, with predrilled holes for the UT-141 coaxial feeder.

Photo A shows the position of the driven element relative to the reflectors and first director. Down East supplies a pre-cut piece of UT-141 cable soldered to a flange-mount N connector. This cable is inserted through the tubing end of the driven element and soldered to the top. Be careful to align the N connector with respect to the boom before soldering the coax! The reason for this action is that the connector and flange will be bent forward to attach under Director #1, with the connector facing the front of the boom. Be sure to flow solder evenly around the shield of the rigid coax line where it attaches to the driven element.

The two boom sections attach using the hardware from elements #D22 and #D23, allowing quick break-down for transporting the yagi. The boom-to-mast assembly consists of two pieces: (1) A machined piece of ½" square tubing and (2) A mast plate with hardware. The tubing fastens to the boom with two 8-32 screws, washers, and nuts. The plate attaches at a right angle with two more 8-32 screws, and the entire assembly can then be bolted to a mast.

The only catch here is that Down East supplies U-bolts for 1" diameter mast stock! If using a larger material, a hole will need to be drilled on to the plate accordingly. Probably the reason(s) this size was arrived at are the accessory stacking frames for two or four "loopers," that use 1" stubs with 2" bolts to make the mast connection. Evidently, Down East expects to sell lots of these in pairs! Keep in mind that the 2345LY (like the 33 cm and 13 cm versions) must be mounted above any mast. If the mast protruded into the loop area, it would seriously detune the antenna.

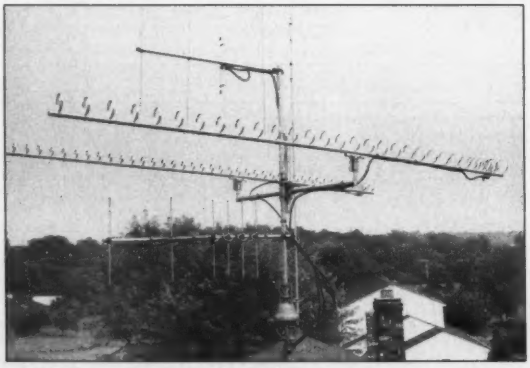

Photo B. The 2345LYK in service (rear) and Down East 3333LYK is front. They make a nice pair for microwave operation!

Technical Data for the Down East Microwave 2345LY

Specification	Rating
Frequency Range:	1.25 to 1.3 GHz
Number of Elements:	45
Boom length:	143 inches (15.7 wavelengths @ 1296.000 MHz)
Weight:	5 pounds
Gain: (3 dB Beamwidth, E-plane)	> 20 dB
Maximum Power Capacity:	550 watts average
VSWR: (measured with Bird 43 and 25K slug @ 1296.100 MHz)	1.05:1

Photo B shows the 2345LY installed on my "solution" to the 1" mast clamps–a custom-welded trident assembly with 1" stubs at either end. (This might be a neat thing for Down East to add to their catalog!) This system allows the use of two separate loopers anywhere along a 1½" to 2" mast. It is also used when I go portable on 903 and 1296. The 2345LY is to the right, with the 3333LYK to the left. The load is sufficient for a garden-variety CD45II rotor to turn without much sweat.

Observations

How does it work? Very well! The pattern of the 2345 is not quite as sharp as my Tonna 55 element yagi, but in everyday use with a transceiver (such as the IC-1271A) or transverter (such as the LT-23S), there was little noticeable difference. Communications were possible from this location to Baltimore, southern New Jersey, and into Massachusetts, using an outboard 60 watt amplifier. It will be interesting to see how the circular polarization obtained from the use of a loop element minimizes "multipath" signals from nearby hills and obstructions.

One advantage of the 2345LY is the absence of a boom brace. The 1" diameter tubing used for the boom, is rigid enough that "sag" isn't evident. Matching was a breeze: Down East suggests bending the driven element to 2.75 inches high for best match. However, I merely soldered the UT-141 cable to the driven element and made no attempt to adjust the height. As the table shows, virtually no reflected power was detected.

Another advantage that "looper" fans are quick to point out is that raindrops and condensation droplets fall to the mounting point of the antenna, minimizing detuning effects that can drive conventional half-wave elements out of resonance. This is certainly true, but note also that heavy, wet snow tends to pack up in loop elements.

Regardless, the Down East Microwave 2345LY is an exceptional value in a high-gain, lightweight yagi for general 23 cm work. Note that the 2345 is also available assembled and tested, but the kit version is easier to ship. Construction is simple and the materials are of high-quality T60-6 aluminum stock with stainless hardware. It should find favor not just with SSB and CW types, but also ATV, packet, and FM operators. 73

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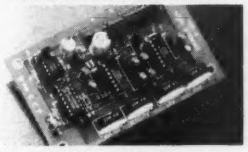

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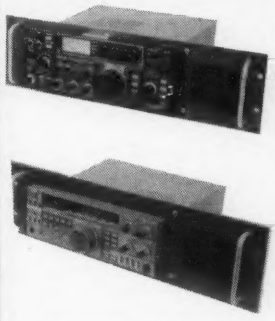

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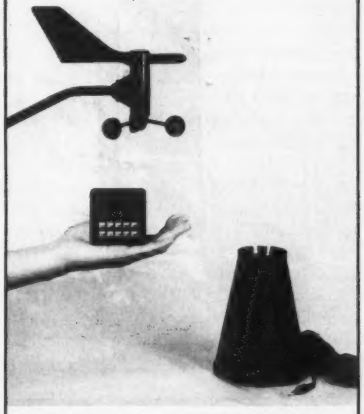

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FN27...Yet Again!(Part 2)

The bulk of the assembly work went fairly quickly on Friday. The weather was excellent (in stark contrast to 1987) with temperatures in the 80s and a light breeze blowing. Many of the antennas had been assembled beforehand and partially broken down for transit. It was a simple matter to get the two meter station up and running in short order. The H-frames fell together beautifully, and the skyline soon filled with 70 feet of tower and 68 elements-worth of yagis!

Ivars and the two Toms set about constructing the UHF/SHF tower. They had to find some way to cram 536 elements onto an 18-foot mast atop the W51 tower trailer! It took nearly all day to do it, but the resulting configuration was worth the effort. It looked like an abstract sculpture! Meanwhile, Steve and Bill assembled the four 6-meter beams in jig time to discover that the rotor atop the W-67 was defunct! Murphy had finally arrived!

Rich arrived about 3 PM with the station tents—brand-new Hillary models he picked up on the way in. The dome design let a lot of light in during the daytime, and was just big enough to accommodate the 7-foot tables laden with equipment. The 6 meter rotor was fixed, and I removed three Honda generators from my pickup—one for each station. Two were 5000-watt units and the remaining unit a 4000-watt model, so we had a fair amount of power on tap. By 6 PM, every station was on the air and percolating nicely, so we took it easy the rest of the night.

Final Moment Draws Near

Saturday found us increasingly tense as 2 PM neared. Would it all work? Would it continue to work? We had our answer right away, as the keying relay failed immediately on 6 meters! Output was low on 2 meters for some strange reason, and the 220 kilowatt was running unsteadily. Oh well...another typical June contest! I did something I'd never done before, and started out on 432 SSB running 250 watts.

Within the next hour, the 6 meter relay problem was solved and we burst onto the band with a vengeance! The 2 meter amplifier was finally retuned, and with the aid of an intermediate amplifier, we were seeing 1500 watts output. Tom Richmond and Tom Hodge spent quite some time tweaking the 220 station, but managed to coax about 1 kW output from it as things stabilized.

What a joy to have separate rotors! I was surprised at the amount of activity on 70 cm early on, and began piling up grid squares. In fact, the first 12 contacts were each made with a different grid! We were definitely being heard on 432. 220 was also enjoying some early activity as the sought-after "Fox Nancy Twenty-Seven" report was given over and over.

Shortly after, Murphy struck again. The 220 station began keying the RF VOX line on the THL250U, which resulted in some high speed data bursts on 70 cm instead of clean CW. Turning on the GaAsFET preamp alleviated the problem, but the 220 signal was "pumping" the front end on 432. Out came the 5-year-old Mirage D1010, and we made do with 130 watts for a while.

Over on 6 meters, the operators managed to go through 3 transverters and 4 preamplifiers while maintaining an excellent QSO rate! Six was opening in all directions except Europe, and our gamble with the four 5-element yagis was paying off in spades. It began to look like we might actually approach last year's total of 204 grids. 2 meters was also enjoying reasonable success, as many rare grids were picked off to the west and south.

Many stations were worked on 903 and 1296 during the activity hours that evening and Sunday morning. However, Murphy also took a swipe at the 2304 station, causing a problem with receiver sensitivity that I was not able to resolve. We were barely able to hear the Rover station in nearby FM28—only 4 miles to the north! It was heartbreaking to know we were heard in FN21, FN20, and FN30, but couldn't reciprocate.

Tom Hodge pulled out his microwave equipment, and we set about making a few Rover contacts on 2304, 3500, and 10,000 MHz. FM27 was easy, as we were about 100 feet apart and knocked off the QSOs in short order. A foray in the car and some nosing around resulted in a somewhat mucky but appropriate path back from FM28 on the three bands. We weren't ambitious enough to drive 40 miles south to FM26, though. Many local operators gave us contacts on 220 and 2 meter FM, following up with a visit to the site to ogle the tower trailers.

"The tropo enhancement at night was truly spectacular."

The tropo enhancement at night was truly spectacular. Stations that were barely 6 dB out of the noise on 1296 were 60 dB stronger at 9 PM! I found myself ragchewing with stations in Long Island, New York, and southern New Jersey on both 903 and 1296, enjoying armchair copy. Even stations along Chesapeake Bay were booming in from Baltimore and points west. If only more stations had gotten on then and taken advantage of it!

Things drew to a close all too soon as the 2304 station went up in smoke, six meters blew another transverter, and the two meter intermediate amplifier kicked the bucket. Fortunately, the antenna rotors held up as we were blessed with light winds all weekend long. I spent the last 10 minutes of the contest trying to work K1TR in FN42 (made it) and we knocked off contacts with north central Ohio on both 2 and 432. The six meter guys made a last, frantic sweep through an opening into Arkansas and the southwest before throwing in the towel.

I had been keeping track of all the contacts on my AMQ portable PC inside Bill's trailer, and was able to come up with a reasonably clean log about half an hour after the contest ended. There was no doubt we bettered our 1987 score—we made over 100 more contacts with far fewer six and two meter openings. The final tally:

Band	QSOs	Grids
50	431	161
144	331	52
220	67	26
432	83	31
903	11	6
1296	35	13
2304	2	2
3500	2	2
10000	2	2

The total was 964 QSOs and 295 grids for 361,080 points. In 1987, we had made 846 QSOs and worked 313 grids (mostly on six) for 330,000 points, so our objective of bettering our score had been achieved. The goal was for 1,000 QSOs and 300 grids...we came darn close! In fact, the only band showing little improvement from 1987 was 432, where we actually worked eight less QSOs but three more grids. It's hard to imagine making more than 1000 contacts from an area as remote as Chincoteague without some incredible band conditions from six meters right on up to the microwave bands.

Kudos

Many people donated time, energy, and equipment to make this effort successful, and I'd like to thank them for it: Deb Davis from ICOM for the '75 series multimodes, Donna Irby from Encomm for allowing their prototype UHF amp to be beta-tested, Everett Gracey of RF Concepts for an RFC 3-312 which performed flawlessly driving the 8877 on 220, The PX Shack for supplying all of the F9FT Tonna antennas, Mike Crawford WA2VUN for his generator, and all of the custom antenna support fabrication; Bill Olson W3HQT for his help in debugging the LMW 13 cm transverter, Dave Mascaro WA3JUF for retuning the 13 cm amp at the last minute, Joel Knoblock of the RF Connection for providing a sample of their new 9913 cable for 432 MHz, and, most of all, Jim Thompson, Secretary of the Curtis Merritt Harbor Committee for his assistance in getting permission to use the site in the first place!

I'll follow up on some of the equipment performance in future columns. See you in November...Above and Beyond! 73

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Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

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Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	<50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	<10mv To 150 MHz <150mv To 600 MHz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	<25mv @ 50 MHz <15mv @ 500 MHz <100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	<10mv To 150 MHz <150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

MINI KITS—EASY TO ASSEMBLE—FUN TO USE

TONE DECODER
A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 **$5.95**

40 WATT 2 mtr PWR AMP
Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, less case and T-R relay.
PA-1, 40 W pwr amp kit **$27.95**
TR-1, RF sensed T-R relay kit **6.95**

COLOR ORGAN
See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110VAC.
ML-1 Kit, **$8.95**

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9 VDC.
VS-1 KIT **$6.95**

VIDEO MODULATOR
Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

LED BLINKY KIT
Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.
BL-1 Kit, **$2.95**

MAD BLASTER
Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC
MB-1 Kit **$4.95**

UNIVERSAL TIMER
Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.
UT-5 Kit. **$5.95**

WHISPER LIGHT
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.
WL-1 Kit **$6.95**

FM WIRELESS MIKE
Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.
FM-1 Kit **$3.95**
FM-2 Kit **$4.95**

SIREN
Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 **$2.95**

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
BM-9 Kit **$5.95**

60 Hz TIME BASE
Runs on 5-15 VDC. Low current (25ma) 1 min/month accuracy
TB-6 Kit **$5.50**
TB-6 Assy. **$9.95**

TELEPHONE TRANSMITTER
Low cost with professional performance. Features include; self phone line powered, tunable from 76 to 100 MHz, polarity antisensitive, compact size (½" x 1¼"), easily installs anywhere on the phone line or inside the instrument itself.
PB-1 KIT **$14.95**

FM RECEIVER
For built-in applications or hobby experimentation. Full fledged superheterodyne receiver, microvolt sensitivity, 10.7 MHz IF. Integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception
FR-1 KIT **$14.95**

FM MINI MIKE
A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.
FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

NEW

MICROWAVE INTRUSION ALARM
A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.
Complete Kit, MD-3 **$16.95**

NEW

SPEECH SCRAMBLER
Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC D8M circuitry. Can also be used to descramble most com. scramblers.
Complete kit, SS-7 **$29.95**
Case kit, CSS-7 **12.95**

ALL NEW KITS

PERSONAL SPEED RADAR
Complete kit, SG-7 **$89.95**

New low cost microwave doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners or virtually anything that moves. Operates at 2.6 GHz with over 1/4 mile range. LED digital readout displays speeds in miles per hour, kilometers per hour or feet per second! Earphone output permits listening to actual doppler shift. Uses two 1 lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

RADIOS

40 & 80 METERS HAM RECEIVERS

Sensitive all mode, AM, CW, SSB receivers for 3.5—4.0 or 7.0—7.5 MHz. Direct conversion design using NE602 IC as featured in QST and ARRL handbooks. Less than 1 μv sensitivity, varactor diode tuned, 50 mw audio output. Runs on 9VDC, has RF gain control. This kit is very easy to build, lots of fun and educational—ideal for the beginner or the old pro. The optional matching case kit features a rugged ABS plastic case with screened graphics. Included are machined aluminum knobs for a well-finished professional look.

40 Meter receiver kit, HR-4 **$24.95** 80 Meter receiver kit, HR-8 **$24.95** Receiver case kit, CHR **$12.95**

QRP TRANSMITTER KITS, 40 & 80 METERS

Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

40 meters QRP rig, QRP-40 **$24.95** 80 meters QRP rig, QRP-80 **$24.95** Case kit, CQRP **$12.95**

AIRCRAFT RECEIVER KIT

Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output. 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1 **$24.95** Receiver case kit, CAR-1 **$12.95**

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

Complete kit, SR-1 **$24.95** Receiver case kit, CSR-1 **$12.95**

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation.

Complete kit, PC-1 **$49.95**

FM COMMUNICATIONS/2 METER RECEIVER

Sensitive superhet FM receiver tunes any 5 MHz segment from 135—175 MHz. Listen to 2 mtr ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

Complete kit, FR-7 **$29.95** Receiver case kit, CFR-7 **$12.95**

NEW MINIKITS—NEW MINIKITS

BROADBAND PREAMP
A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.
Complete kit, SA-7 **$12.95**

LIGHT BEAM COMMUNICATORS
Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.
Transmitter kit, LB-6 **$8.95**
Receiver kit, LB-5 **$9.95**

HIGH POWER FM WIRELESS MIKE
A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC
FM-4 kit **$9.95**
Sensitive microphone cartridge **$2.95**

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HF Equipment	Regular	SALE
IC-781 Xcvr/Rcvr/ps/tuner/scope	5995.00	Call

IC-761 Xcvr/Rcvr/ps/tuner	2699.00	2369
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter	149.00	139.95
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	109.95
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	1469
PS-35 Internal power supply	219.00	199.95
FL-32A 500 Hz CW filter (1st IF)	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	109.95
FL-53A 250 Hz CW filter (2nd IF)	115.00	109.95
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	

IC-735 HF transceiver/SW rcvr/mic	1099.00	959.95
PS-55 External power supply	219.00	199.95
AT-150 Automatic antenna tuner	445.00	369.95
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

Other Accessories	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	1699
PS-15 20A external power supply	175.00	159.95
PS-30 Systems p/s w/cord, 6-pin plug	349.00	319.95
MB Mobile mount, 735/751A/761A	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
PP-1 Speaker/patch	179.00	164.95
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	139.95
AT-100 100W 8-band auto. antenna tuner	445.00	389.95
AT-500 500W 9-band auto. antenna tuner	589.00	519.95
AH-2 8-band tuner w/mount & whip	659.00	589.95
AH-2A Antenna tuner system, only	519.00	449.95
GC-5 World clock	91.95	79.95

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IC-275H 100W 2m FM/SSB/CW	1399.00	1229
IC-375A 25W 220 FM/SSB/CW	1399.00	1099
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	1099
IC-475H 75W 440 FM/SSB/CW	1599.00	1289
IC-575A 25W 6/10m xcvr w/ps	1399.00	1249

IC-471H 75W 430-450 **Closeout**	1399.00	989.95
PS-35 Internal power supply	219.00	199.95
AG-35 Mast mounted preamp	99.95	
AG-35 (Purchased with IC-471H)	99.95	9.95
SM-6 Desk microphone	47.95	
EX-310 Voice synthesizer	59.00	
TS-32 CommSpec encode/decoder	59.95	
UT-15 Encoder/decoder interface	34.00	
UT-15S UT-15S w/TS-32 installed	96.00	

VHF/UHF/1.2 GHz Mobiles	Regular	SALE
IC-37A 25w 220 FM/TTP mic **Closeout**	499.00	349.95
IC-47A 25w 440 FM/TTP mic **Closeout**	549.00	399.95
PS-45 Compact 8A power supply	145.00	134.95
UT-16/EX-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28H 45W 2m FM, **TTP** mic	499.00	439.95
IC-38A 25W 220 FM, regular mic	459.00	349.95
IC-38A 25W 220 FM, **TTP** mic	489.00	389.95
IC-48A 25W 440-450 FM, regular mic	459.00	369.95
IC-48A 25W 440-450 FM, **TTP** mic	509.00	449.95
HM-14 Extra TTP microphone	59.00	
UT-28 Digital code squelch	39.50	
UT-29 Tone squelch decoder	46.00	
HM-16 Speaker/microphone	34.00	
IC-228A 25W 2m FM/TTP scan mic	509.00	449.95
IC-228H 45W 2m FM/TTP scan mic	539.00	479.95
UT-40 Pocket beep function	45.00	
IC-900A Transceiver controller	639.00	569.95
UX-19A 10m 10W band unit	299.00	269.95
UX-29A 2m 25W band unit	299.00	269.95
UX-29H 2m 45W band unit	349.00	319.95
UX-39A 220MHz 25W band unit	349.00	289.95
UX-49A 440MHz 25W band unit	349.00	319.95
UX-59A 6m 10W unit	349.00	319.95
UX-129A 1.2GHz 10W band unit	549.00	499.95
IC-1200A 10W 1.2GHz FM Mobile	699.00	549.95
IC-3200A 25W 2m/440 FM w/TTP	695.00	529.95
UT-23 Voice synthesizer	34.99	
AH-32 2m/440 Dual Band antenna	39.00	
AHB-32 Trunk-lip mount	35.00	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	22.00	
Larsen PO-MM Magnetic mount	22.00	
RP-1210 1.2GHz 10W 99 ch FM xcvr	1529.00	1349
RP-2210 220MHz 25W repeater	1649.00	1469
RP-3010 440MHz 10W FM repeater	1299.00	1149

Due to the size of the ICOM product line, some accessory items are not listed. If you have a question, please call. All prices shown are subject to change without notice.

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Hand-helds	Regular	SALE
IC-2A 2-meters	289.00	259.95
IC-2AT with TTP	319.00	279.95
IC-3AT 220 MHz, TTP	349.00	299.95
IC-4AT 440 MHz, TTP	349.00	299.95
IC-02AT/High Power	409.00	349.95
IC-03AT for 220 MHz	449.00	349.95
IC-04AT for 440 MHz	449.00	389.95
IC-u2AT for 2m w/TTP	329.00	289.95
IC-u4AT 440 MHz, TTP	369.00	299.95
IC-2GAT for 2m, TTP	429.00	379.95
IC-4GAT 440MHz, TTP	449.00	399.95
IC-32AT 2m/440MHz	629.00	559.95

IC-u2A for 2m **w/o TTP**
Reg. $299 - **Closeout $249.95**

Aircraft band handhelds	Regular	SALE
IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	473.00	369.95
A-2 5W PEP synth. aircraft HT	525.00	479.95
A-20 Synth. aircraft HT w/VOR	625.00	569.95

Accessories for all except micros	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	79.00
BP-8 800mah/8.4V Nicad Pak - use BC-35	79.00
BC-35 Drop in desk charger for all batteries	79.00
BC-16U Wall charger for BP7/BP8	21.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	49.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50
BP-4 Alkaline battery case	16.00
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00
CA-5 5/8-wave telescoping 2m antenna	19.95
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.65
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	24.50
MB-16D Mobile mtg. bkt for all HTs	25.99
LC-2AT Leather case for standard models	54.50
RB-1 Vinyl waterproof radio bag	35.95
HM-9 Speaker microphone	47.00
HS-10 Boom microphone/headset	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
HS-10SB PTT unit for HS-10	24.50
SS-32SMP Commspec 32-tone encoder	27.95

For other HT Accessories not listed please CALL

Receivers	Regular	SALE
R-71A 100kHz to 30MHz receiver	$999.00	869.95
RC-11 Infrared remote controller	70.99	
FL-32A 500 Hz CW filter	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-44A SSB filter (2nd IF)	178.00	159.95
EX-257 FM unit	49.00	
EX-310 Voice synthesizer	59.00	
CR-64 High stability oscillator xtal	79.00	
SP-3 External speaker	65.00	
CK-70 (EX-299) 12V DC option	12.99	
MB-12 Mobile mount	25.99	
R-7000 25MHz to 2GHz scan rcvr	1199.00	1049
RC-12 Infrared remote controller	70.99	
EX-310 Voice synthesizer	59.00	
TV-R7000 ATV unit	139.00	129.95
AH-7000 Radiating antenna	99.00	(14)

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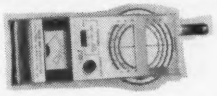

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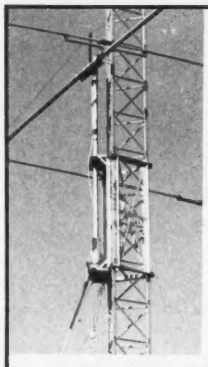

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BASIC RTTY

September. the thoughts that it stirs are profound indeed. For the child, a return to school. For the parents, their child's return to school! Hmmm ... I think I found a congruence there. Anyway, whether back to school or back to basics, this time of year is just right for looking at a letter I recently received.

Stan Rutherford WØEUG in W. Des Moines, Iowa, is interested in getting onto, as he puts it, "Just plain RTTY; no packet, no AMTOR or any other of that space age stuff." He has an HF transceiver and simple computer (C-64), and wants to know what else he needs.

Well, Stan, you already have the kernel of a very capable RTTY station. Your transceiver is modern and quite capable of SSB operation, which correlates with a good capacity for RTTY as well. The computer can serve as the "glass terminal" for the station. All that you need is a way to convert the computer-standard ASCII, used by the computer, to RTTY-standard Murray, used on the air. There are *at least* three ways to do this.

The cheapest way is to secure a program to enable the C-64 to operate on RTTY directly, either alone or with a simple, one-chip demodulator. I am not aware of any software packages for the C-64 for this purpose, as I am for the TRS-80 CoCo, but I do not doubt that they exist. (Three days after the publication of this article I will receive notice of no fewer than eight of them!)

Converting the audio output of your receiver to the voltage blips your computer uses may require a hardware device variously referred to as a "TU" (Terminal Unit), Demodulator, or RTTY Interface. Staying cheap for a second, designs for a one-chip version have been covered here in RTTY Loop in the past, and are adequate for strong signal work or VHF, where noise is not a problem.

Transmitting at this level can take several avenues. If the computer is capable of putting out a clean sine wave, that tone itself, properly shifted and encoded, can be used to key the transmitter. Otherwise, another one-chip card can be put together to convert TTL signals to audio tones. As with the demodulator, simple one-chip AFSK generators have been detailed in past issues of RTTY Loop.

The next step up, in cost if nothing else, would find you using a hardware card to plug into the C-64 to operate on RTTY. These are available from several sources. Check the ads here in *73*. Back issues may also prove fruitful, as manufacturers seem intent on adding the latest features (and costs), rather than keeping a product simple and cheap.

And, finally, there is the dedicated RTTY interface box. Ranging from simple converters to elegant multi-mode wonders, these little LED-encrusted bricks make operating on RTTY little more trouble than calling up the local bulletin board system.

Of course, if you get such a multi-media wonder, it might not be long before you wonder just what that PKT or ARQ light is all about. You might very well find that some of the "space age stuff" isn't all that exotic, after all!

RTTY on the CoCo

Malcolm Hall KE5OK, in McGehee, Arkansas, is another beginner. Malcolm has a TRS-80 Color Computer II, and wants to put it onto RTTY, again as simply as possible. He notes that when he turns the computer on, the screen reads "COLOR BASIC 1.2 (C) 1982 TANDY," and wonders about the capabilities of this machine.

In an all too familiar plight, Malcolm relates going to the local Radio Shack, asking about RTTY for the CoCo, and they did not even know what he was talking about.

He also notes that, while he has seen some programs published for RTTY, they were for different machines and "the commands are different from mine."

Well, to begin with, Malcolm, the machine you possess is equipped with Color BASIC, the simplest BASIC to come on a CoCo. BASIC is, however, far too slow on the CoCo, or most machines for that matter, to be used in the conversion of ASCII to RTTY. While using machine language may seem to be an obstacle to you, it really can work to your advantage.

By using a program written in machine language, the language directly understood by the CPU of your computer, you are freed from the restraints placed upon the system by the resident version of BASIC. Such programs have been written for the CoCo, the most recent of which was published in the January 1988 issue of RTTY Loop. If you can't get a copy locally, send me a tape or disk, with $2 and a stamped, self-addressed mailer, and I will be happy to send you a copy of the program.

On another note, Malcolm asks whether he needs a printer, or if the video screen will suffice. Again, it depends on what you want to do. For simple ragchews, I can't see any more need to produce a paper copy of a RTTY QSO than to make a transcript of the conversation I had on the 2 meter repeater this afternoon. If, on the other hand, you are handling messages, or are into RTTY pictures, then a printer becomes essential. Almost any printer will do.

Not all beginners use simple computers. H. Jack Meadows WD7I of Mesa, Arizona, notes that he has been inactive on RTTY for ten years, since giving away his Model 19, and that things certainly have changed. He wonders what it would take to put his MacIntosh SE computer onto RTTY, and suggests an AEA PK-232 "plus what?"

How about a cable and modem program, Jack? That's about all it would take with this class of "smart demodulator." Talking to any of these upper level TUs is really little different than talking to a telephone modem. As we discussed last month, a dedicated program, such as the kind published for the PC clones, does make life easier, but it is not absolutely necessary. I think whatever communications program you have would be an excellent starting point. Then again, I may very well hear of a specific PK-232 -> Mac interface shortly after this column sees the light of day!

In Search Of....

Every once in a while someone drops me a note in which he or she tries to enlist my aid in search of something or other in the RTTY field. Occasionally, I have even heard of the item being sought. Bingo for this one.

Charles Gelsinger of Albuquerque, New Mexico, has been looking for two TTY re-inkers that were used, he believes, on Models 15 and 19. He describes a very small unit, about one by two inches, which was mounted in the ribbon path to keep the ribbon freshly inked.

Emerson Cyrus 8P6QA writes from Barbados of his interest in a CW program in addition to the RTTY program for the Color Computer. Well, Emerson, I have not seen a public domain or shareware CW program for the CoCo, yet. There are several RTTY programs, several of which have been featured in this column, and a few commercial CW programs, but I have seen nothing from the non-commercial sector.

I have received more than a few questions for such an animal. Does anyone know of a true CW program, as opposed to just a Morse tutor? Let me know, okay?

Dr. James Kretzschmar N4HCJ of Davis, California, is interested in receiving commercial RTTY, such as from the news services. He wonders if there is any way to do this "without involving the purchase of a computer."

Sure. Go out and purchase a commercial RTTY receiving setup. Otherwise, you are going to have to deal with the fact that commercial stations use a variety of shifts, speeds, and codes which render them far different in many respects from ordinary amateur RTTY.

But, assuming you are not rich enough to afford a commercial demodulator, even though the commercial units use them as well, you are going to have to bite the bullet and get a computer. Now, this can be a dedicated computerized interface, such as the popular AEA PK-232, or a big commercial terminal. I think you will find that a unit such as the PK-232 will decode about anything up to a certain level.

To control the interface you will need some sort of terminal, which may be just that—a dumb terminal—or an inexpensive computer, such as a simple CoCo or C-64, running a terminal program. For output or hard copy from the setup, about any printer will do. It's going to cost you about $500 for a setup like this, or perhaps a tad more (not including receiver), but it should be worth it. Let me know how things turn out. 73

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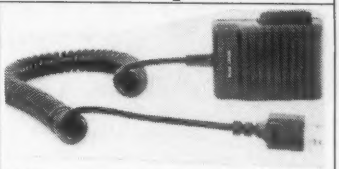

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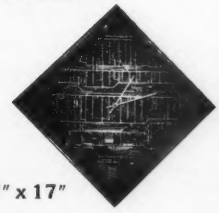

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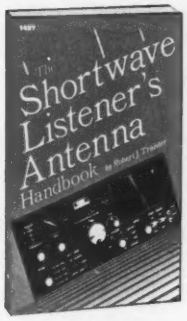

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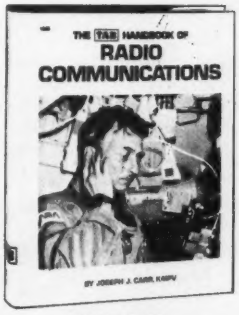

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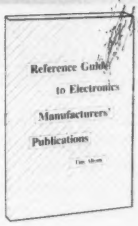

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HAL COMMUNICATION CORP.

Hal Communications Corp., is proud to announce the new ST-7000 HF Packet Modem. The ST-7000 was designed specifically for 300 baud HF packet. Included is an AGC-controlled AM signal processing, a tuning indicator, and a choice between the standard 200 Hz shift mode or 600 Hz shift mode. Both are fully supported by separate optimized 6-pole input filters, and a 40 dB AGC system. The standard 200 Hz shift mode uses phase-locked loop (PLL) detector, whereas the 600 Hz shift mode uses separate 4-pole Mark/Space filters, active detectors, and a 3-pole post-detection filter. The transmit tone generator uses a crystal-based 10-step sine-wave synthesizer circuit. The ST-7000 interfaces to any existing packet TNC via RS-232C, TTL, or TNC audio tones. The ST-7000 is available for $299, including wall-mount power supply. For more information contact *HAL Communications Corp., PO Box 365, Urbana IL 61801; 217-367-7373,* or circle Reader Service number 210.

ICOM

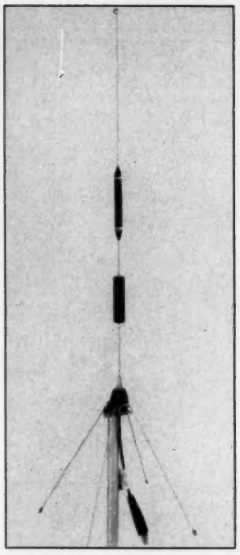
ICOM introduces the IC-3210 25 watt, 2 meter and 440 MHz dual band mobile transceiver, with full duplex operation and wideband coverage. It has 20 memory channels for two meters and 70 cm, which store all relevant information. The Programmed scan function scans all memory channels or lock-out channels in the memory sequence. Priority Watch monitors the call channel every five seconds while operating on another frequency. Price: $739. For further specifications, contact *ICOM America, Inc., at 206-454-8155.* Or circle Reader Service number 201.

EDMUND SCIENTIFIC COMPANY

Edmund Scientific Company's 3-inch torch features a piezo-electric ignition system, two flame levels (800°C to 1300°C), and uses butane gas. It solders, brazes, and sweats, and can be used for melting, shaping, fusing plastics, or thawing frozen locks. The torch comes with a stand for free-standing use. The price is $39.95 plus $2.50 postage. Order from *Edmund Scientific Company, 5552 Edscorp Bldg., Barrington NJ 08007.* Or for more information circle Reader Service number 211.

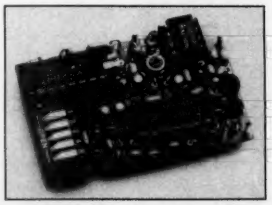
THE ANTENNA SPECIALISTS CO.

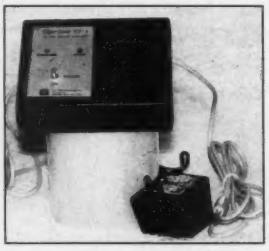
All-band scanner antennas that provide enhanced performance up to 1000 MHz are now available from The Antenna Specialists Company. Models MON-52 (mobile) and MON-58 (base station) feature MICRO-CHOKE™, which gives pinpoint resonance at 800 MHz scanning frequencies and concentrated beam focus at low radiation angles for maximum range monitoring. Scanners can pick up police and emergency communications These all-band antennas offer coverage from 25–1000 MHz at low and high VHF and UHF bands. The mobile version has a no-holes, "Quick Grip" trunk lid mount and coax cable with installed pin plug and sells for $52.50. The base station antenna has an easy one-clamp installation and sells for $42.95. For more information, contact *The Antenna Specialists Co., 30500 Bruce Industrial Parkway, Cleveland OH 44139-3996; 216-349-8400.* Or circle Reader Service number 209.



COMMUNICATIONS SPECIALISTS, INC.

The TS-32P Programmable CTCSS Encoder-Decoder is now available from Communications Specialists. It has all the features of their TS-32, but uses a new microcircuit, the IC-110, for tone versatility. The IC-110 contains a 32-bit reprogrammable memory which allows the shop to specify any 32-tone frequencies from 15 Hz to 255 Hz. The TS-32P can be configured to provide multi-tone switching of up to six tones, without requiring diode networks. There is also easy access to any non-standard tone frequency. The 32-location tone memory can be changed in the service shop with a handheld programmer available from Communications Specialists or by returning it to the factory for re-programming at no charge. The TS-32P operates on 6 to 25V DC. Price, $57.95. *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; 800-854-0547 or 714-998-3021. Circle Reader Service number 203 for more information.*



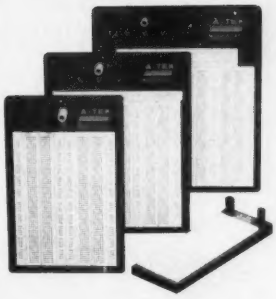


ELECTRON PROCESSING, INC.

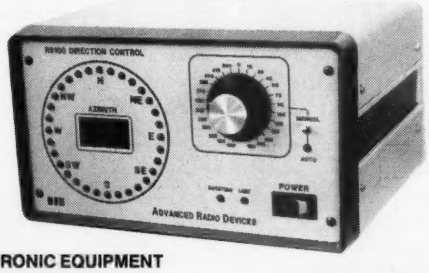
Electron Processing, Inc. has added the Tape-Saver TS-1 to their line of SWL and scanner accessories. It provides scanner owners with a way of connecting their cassette recorder to the scanner so that they won't waste recording tape during periods of scanner inactivity. The Tape Saver TS-1 automatically switches the cassette recorder on and off by means of the remote control jack on the user-supplied recorder. Connect the Tape-Saver TS-1 to the scanner and tape recorder via standard mini plugs. A submini plug connects to the recorder for ON/OFF control. Pricing starts at $49.95 with quantity discounts. Contact *Electron Processing, Inc., Sales Department, PO Box 708, Medford NY 11763; 516-764-9798.* Or circle Reader Service number 208 for more information.

DAVLE TECH INC.

New solderless circuit board kits are available from Davle Tech Inc. for the electronic technician, lab technician or hobbyist. Distance between the tie-point contact clip is 2.5mm (0.1"). They can accept all components with leads or solid wire AWG 22–30 (0.3–0.8mm) and accept all DIP sizes. The contacts are made of precision formed nickel, silver, or gold plated contact material, highly conductive, with the initial contact resistance less than 1 milliohm at 1 kHz. Models include the B-147-N for $52.50, B-147-G for $84, B-124-N for $27, B-124-G for $42, B-112A-N for $16, B-112A-G for $19.20, B-64D-N for $290, and the



B-64D-G for $390. Contact *Davle Tech Inc., 2-05 Banta Place, Fair Lawn, NJ 07410; 201-796-1720.* For more information circle Reader Service number 206.



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The R9100 heavy duty antenna rotator from Advanced Radio Devices is available from EEB. The R9100 has 10,000 in.-lbs. of torque, 23,000 in.-lbs. braking, and will support a 2000 lb. vertical load. The unit fits inside the Rohn 45 tower and weighs 230 pounds. The control unit provides both analog and digital displays, manual control, and an RS-232 interface for external computer control. Software is provided. Suggested list price is $3,975. For more information contact *Electronic Equipment Bank, 516 Mill St., Vienna VA 22180; 800-368-3270 or 703-938-3350.* Or circle Reader Service number 212.

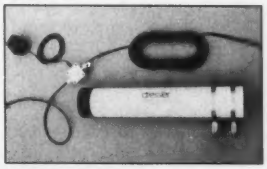
RAPID SYSTEMS, INC.

Rapid Systems announces their new R3200 logic analyzer peripheral for PCs. It has eight channels at 100 MHz or 16 channels at 50 MHz or 24 channels at 25 MHz, for flexibility in digital testing and analysis. The R3200 features 8K per channel memory, using eight channels, waveform zooming, store/retrieve/print waveforms, timing and state analysis, internal sample and reference memories, and advanced triggering using AND, OR, or NOT.

No programming skills are required. Connect the R3200 to the PC bus with the supplied interface card, and run the software. The hardware, connection probes, software, and user manuals are priced at $1,995. *Rapid Systems, Inc., 433 N. 34th St., Seattle WA 98103. 206-547-8311.* For more information circle Reader Service number 213.

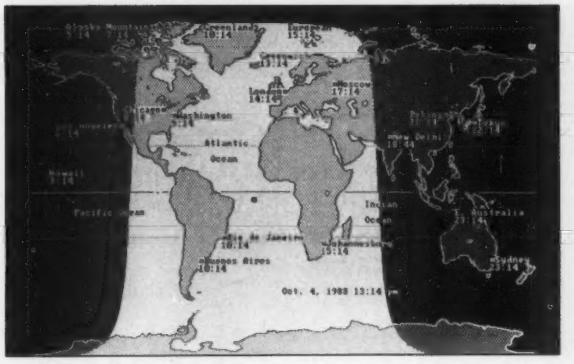
GILFER ASSOCIATES, INC.

The Dressler ARA 900 is a VHF/UHF active receiving antenna, capable of capturing signals from 50–900 MHz. The ARA 900 cylinder contains a wideband amplifier, and an impedance matching network. It can be mounted indoors or outdoors. The supplied lead-in coax is 25 feet long and can be replaced if desired, by any length coax with PL-259 fittings up to 100 feet. The coupler terminates in an N-type connector, fitting the top of the line scanners, such as the ICOM R-7000 receiver. Price: $189 (includes power adaptor) plus $8 S&H. Distributed by *Gilfer Shortwave, 52 Park Avenue, Park Ridge NJ 07656; 201-391-7887.* Circle Reader Service number 205 for more information.



KENWOOD

Kenwood's TH-55AT 1200 MHz Pocket Transceiver has a frequency coverage of 1258–1300 MHz, an easy-to-read LCD display, and tone alert monitoring system built in. It uses the same accessories as the TH-25AT Series HTs, except for frequency-related items, such as antennas. Its 14 memory channels store frequency, repeater offsets, subtone frequencies, CTCSS and reverse information. Two of the memory channels store transmit and receive frequencies independently, allowing operation on repeaters with both standard and odd offsets. Other features include frequency lock switch, memory recall, memory shift, memory and band scan, auto power-off function, and programmable CTCSS tone encoder/decoder. Suggested retail price, $499.95. *Kenwood USA Corporation, 2201 E. Dominguez Street, Long Beach CA 90810; 213-639-4200.*



MFJ ENTERPRISES, INC.

The MFJ-1286 Gray Line DX Advantage/Terminator is a computerized DXing tool for IBM PC/XT/AT and compatibles. It gives users instant access to Gray Line positions for any place in the world, at any time and date from 1980 to 1999. A high resolution map displays the moving Gray Line, UTC times, time zones, sun position, and latitude/longitude markers. It corrects the north/south position of the sun and the earth's curvature, and features a high speed display mode with pause. The DX Advantage can run by itself or in conjunction with other software, including graphics. The DX Advantage can also be customized to suit your DXing needs. Price, $29.95. Contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State, MS 39762. 601-323-5869. Order at 800-647-1800.* Or circle Reader Service number 202.

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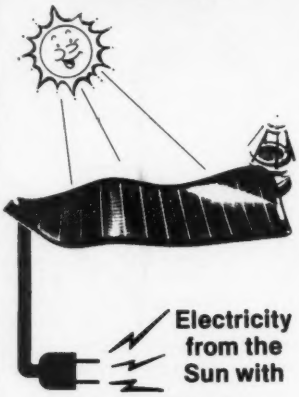

- Charge batteries on stored machinery
- Light your tent
- Run fans
- Run remote transmitters
- Light signs
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- Light your home
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1 ANTENNA 9 BANDS

The GARANT GD-6 dipole was tested and recommended by TCA (The Canadian Amateur; similar to QST) in June 1985. The GD-6 and GD-8 were tested and recommended as first choice in a test of three wire antennas by the CNIB (Canadian National Institute for the Blind.) TCA and CNIB confirmed that the GARANT GD-antennas need no tuner on all bands tested.

MODEL	BANDS	LENGTH
GD-6:	80-40-20-17-12-10M	137'
GD-8:	80-40-30-20-17-15-12-10M	137'
GD-7:	160-80-40-20-17-12-10M	255'
GD-9:	160-80-40-30-20-17-15-12-10M	255'

Choose between 500W PEP or 2KW versions. Install as a horizontal dipole or an inverted-V. SWR usually better than 1.5:1. No tuner needed if properly installed. See letters of our ham customers in our data report. The GD-windom dipoles are no dummy load antennas. Our special GD-balun (500W or 2KW) matches the low impedance (50Ω) coax feedline to the high impedance windom-type antenna. All GARANT GD-windom dipoles come with a 3-year limited warranty and a 10-day money-back guarantee. Who else has that much confidence in his products?

VE2MNL, Michel: "I have installed my GD-7. Only one antenna to cover 7 bands with practically perfect SWR on all bands. **VE1AZZ**, Gordon on his GD-8: "I find the SWR exactly as you claimed." **VE7TK**, John on his GD-9: "FB on all bands. Great for DX." **VE7BKU**, Rob on his GD-8: "A great antenna. Excellent bandwidth." **VE1VCO**, Stu: "Very pleased with the GD-6/2KW. In less than six months operation have logged over 85 different countries. Recommend it to anyone considering a wire antenna."

FREE DATA Report

Write or phone for our free data report on all our GARANT GD-windom dipoles with technical data, actual SWR curves, customer comments, and our low factory direct prices. Take advantage of our sale prices. We ship worldwide & accept VISA or MASTERCARD.

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Multiplication Factor: 12 Times
Power Rating: 2000 CW, 4000 PEP
Height: 10 Feet
Weight: 8.0 Lbs.
Materials: Anodized 6063T-6 Aircraft Aluminum Tubing
Requires 1 Coaxial Cable for Hook-Up

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Specifications
Gain: Horizontal - 5.25 DB, Vertical - 4.75 DB
Multiplication Factors: Horizontal - 17 Times, Vertical - 15 Times
Horz. to Vert. Separation: 20 - 25 DB
Power Rating: 2000 CW, 4000 PEP
Height: 11 Feet
Weight: 10 Lbs.
Materials: Anodized 6063T-6 Aircraft Aluminum Tubing
Requires 2 Separate Coaxial Cables for Hook-Up

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73 Review *by Ray Weber KA1JJN*

Motron Auto Kall Model AK-10

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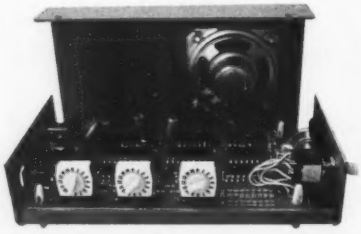
Price Class: $90

Here's a device almost anyone can find a use for. The AK-10 attaches to any FM receiver and decodes touch tones to activate both an LED indicator and a speaker output. It has built-in switches that set it up to decode any 3 digit touch-tone code, including A through C.

The unit is in a small 5½" by 3" by 1¼" case and includes an external AC power supply and audio patch cord.

The unit performed amazingly well with low quieting signals. It took about 50% quieting for reliable operation. It operated well on 12 volts DC, and with the included AC supply.



The AK-10 uses an SSI-202P tone decoder chip to provide crystal-controlled, reliable decoding. This chip is known for its excellent performance, and exhibited it in this test. It reset when getting a wrong signal and did not false. Low power CMOS chips are used throughout for minimal current consumption.

The AK-10 connects to the speaker audio and provides an internal speaker that is activated when the proper tones are received. The decoder can be bypassed with a front panel switch.

The unit resets automatically after being tripped, but leaves the front panel LED lit to indicate that it received a signal.

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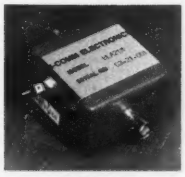

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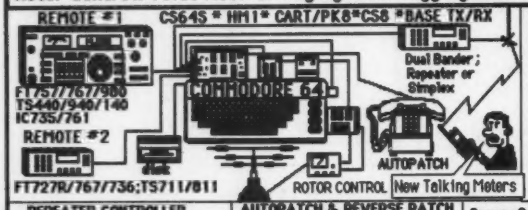

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6	Antenna Suggestions	Dec 77
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10	Radio Shack TRC-11 and TRC-74	Aug 78
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17	Sharp Model CB-800A	Jan 79
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21	Royce I-655	Nov 79
22	Johnson Viking 352	Nov 79
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24	CB to 10 FM - Part II	Feb 80
25	More Talk Power for the TRC-11	Mar 80
26	Sears RoadTalker 40	Mar 80
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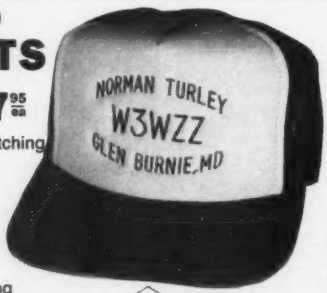

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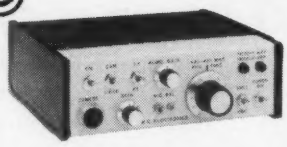

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SPECIAL EVENTS

Ham Doings Across the Country

HUNTINGTON WV
OCT 1

The Tri-State Amateur Radio Association, Inc., is sponsoring the T.A.R.A. Hamfest '88 and Computer Fair at the Huntington Civic Center, from 9 AM to 4 PM. Admission, $4. Forums, VE testing, giant flea market, dealers, all indoors. No stairs for handicapped. Talk-in, 146.16/.76. Contact *Charley Shumaker N8IKP, PO Box 4120, Huntington WV 25729; 304-523-5264.*

WARRINGTON PA
OCT 1–2

Mt. Airy VHF ARC, the Pack Rats, invite all amateurs and friends to the 12th Annual Mid-Atlantic VHF Conference on Oct. 1, and to the 17th Annual Hamarama on Oct 2. Advance registration for the conference is $5, $6 at door. This includes admission to the flea market. Flea market only is $4, $7 per carload. Selling spaces, $6 each. Gate opens at 6 AM; bring your own tables. Send payment to *Hamarama '88, PO Box 311, Southhampton PA 18966. Contact Pat Cawthorne WB3DNI, at 215-672-5289.*

WICHITA KS
OCT 1–2

The Wichita ARC will host the annual ARRL Kansas convention at the Red Coach Inn. Doors open at 9 AM, admission $5 pre-registered, $6 at door. Huge indoor flea market, commercial displays, technical seminars, meetings, banquets, prizes, Wouff Hong ceremony, entertainment. Talk-in on 146.82 for out-of-town hams, 146.94 for local hams. For advance registration, contact *Vern Heinsohn WAØZWW, 950 Back Bay, Wichita KS 67203.*

BENTON HARBOR MI
OCT 2

The 1988 "Blossomland Blast" will be from 8 AM to 4 PM at Lake Michigan College. I-94 Exit 30, East to Yore Road, North to entrance. For info, write *"Blast," PO Box 175, St. Joseph MI 49085.*

HAMMOND IN
OCT 2

The Lake County ARC is sponsoring its 16th annual Hamfest at the Hammond National Guard Armory. Limited tables, $5 each. Admission, $3.50. Set up, 6 AM. VE testing. ARRL, ARES, MARS information available. Talk-in on the Lake County ARC repeater 147 or 146.52 simplex. Contact *Lucy Schendera N9DTG, 812 E. 40th Place, Griffith, IN 46319; 219-923-4873.*

ROCKFORD IL
OCT 2

The ARRL Illinois State Convention will be held in conjunction with the Rockford Hamfest-88/ Computer Fair from 9 AM to 4 PM at the National Guard Armory. ARRL forum, ham and computer talks, technical demonstrations, commercial exhibits, large flea market (tables $7 in advance, $10 at door), and VE exams. Tickets $3 in advance, $4 at door. Talk-in on 146.01/.61, 223.68/224.28, and 146.52 simplex. For seller information, contact *Roger Sawvell KD9MQ at 815-633-0520.* For general info, *Jim Miller W4JR, at 815-397-4602.* Send SASE for reservations to *Rockford Hamfest, PO Box 10003, Rockford IL 61131.*

ROME GA
OCT 2

The Rome hamfest, sponsored by the Coosa Valley ARC, Inc., will be at the Rome Civic Center. Admission, free. Inside tables, $6; outside spaces, $2. Homemade Bar-B-Q and stew, camper parking, no hookups. VE exams, drawings, bingo, contests, prizes. Reservations requested, walk-ins OK. Contact *James WD4JHF or Linda WD4JHG Sineath, 1124 New Rosedale Rd., NE Armuchee, GA 30105; 404-291-9767.*

SPRINGFIELD OH
OCT 2

The Independent Radio Association will hold the 6th Annual Springfield Hamfest and Computer Expo at the Clark County Fairgrounds from 8 AM to 4 PM. All vendor and swap-meet activities indoors. Admission, $3 (advance, $2). Tables, $7 (advance, $6). Talk-in on 145.45 and 224.26 MHz. Write the *Independent Radio Association, PO Box 523, Springfield OH 45501* or call *Gary WB8YUC at 513-399-4732.*

ST. CHARLES MO
OCT 2

St. Peters ARC's 4th Annual Swapfest will be in McNair Park Day Care Center from 6 AM to 2 PM. Admission $1 to buy or sell. Door prizes. Talk-in on 145.41 repeater and 146.52 simplex. Call *Allen Underdown at 314-723-4200.*

WEST LIBERTY IA
OCT 2

The Muscatine and Iowa City ARC is having their Southeast Iowa Hamfest at the West Liberty Fairgrounds. Gate opens at 7 AM. Advance admission, $3; at door, $4. Register for exams as soon as possible with *Tom Krainer KEØY, 905 Leroy St., Muscatine IA 52761; 319-264-3259.* For table reservations, contact *Ken Kucera KAØY, RR2 Box 52A, Riverside IA 52327; 319-648-5037.* Talk-in on 146.25/ .85, 146.31/.91.

YONKERS NY
OCT 2

The Yonkers ARC is sponsoring the Electronics Fair and Giant Flea Market at the Yonkers Municipal Parking Garage from 9 AM to 3 PM. Two floors of new and used equipment, hourly prizes, giant auction, live demonstrations. Admission, $3. Sellers, $8 per parking space. Bring tables. Talk-in on 146.865/R, 440.150/R, and 146.52. *YARC, 53 Hayward St., Yonkers NY 10704; 914-969-1053.*

HARLINGEN TX
OCT 7–8

The South Texas Amateur Repeater Society (STARS) is sponsoring the commemorative station N5CAF to celebrate the Confederate Air Force's annual Air Show in Harlingen. They will attempt to contact WWII aircraft in the CAF inventory. Listen for operation from a B-29, B-17, B-25, P-51, P-40, etc. Station operation from 8 AM to 8 PM on SSB frequencies 14260, 21360, and 28460. For certificate QSL, send QSL and SASE to *Dr. David Woolweaver K5RAV, 2210 S. 77 Sunshine Strip, Harlingen TX 78550.*

STRATFORD CT
OCT 8

The Stratford ARC will operate W1ORS from 1300Z to 1900Z to celebrate the club's 50th anniversary. Suggested frequencies, lower third of the General 40, 20, 15 meter bands and the Novice portion of 10 meters. For certificate, send QSL, contact number, and 8½"x 11" SASE (2 units of postage, please) to *KA1JKT, 307 Park Street, Stratford CT 06497.*

POTEAU OK
OCT 8–9

The Fort Smith (Arkansas) Area ARC will operate special event station W5ANR in conjunction with the 2nd Annual Green Country Sorghum Festival in Poteau, Oklahoma. Operation is from 1400–2300Z the 8th and 1400–2200Z the 9th in the lower 30 kHz of the general phone bands, 28.435 in Novice phone, and 145.01 on packet. For certificate, send QSL and SASE to *FSAARC, W5ANR, Box 32, Fort Smith AR 72902-0032.*

LANSING MI
OCT 9

The Central Michigan ARC and the Lansing Civil Defense Repeater Association are sponsoring Ham-Fair '88 from 8 AM to 3 PM in the Lansing Civic Center's Exhibition Hall. Vendors, spacious flea market, plenty of tables available ($1.50 per foot). Admission, $3.50. Talk-in frequencies are 145.39 and 146.94. Contact *Rowena Elrod KA8OBS, 111 Lancelot Place, Lansing MI 48906; 517-482-9650.*

LIMA OH
OCT 9

The Northwest Ohio ARC will hold their annual Hamfest at the Allen County Fairgrounds. Set up after 3 PM Saturday, all night security provided. Tickets, $3.50 advance; $4 at door. Tables $8, half-table $4. Exams all levels, Form 610 with copy of present license with SASE to *W8TY 1370 Stevick Rd., Lima OH 45807.* Tickets and table reservations, SASE to *WD8BND, PO Box 211, Lima OH 45802; 419-647-6513.* Talk-in on 146.67/.07, 147.03/.63, 444.925/449.925. *All areas at Hamfest handicap accessible.*

QUEENS NY
OCT 9

The Hall of Science ARC Hamfest will be at the New York Hall of Science parking lot in Flushing Meadow Park. Doors open at 9 AM. Set up is after 7:30 AM. Amateur radio exhibit station, tune-up clinic, films. Admission, $3. Sellers, $5 per space. Talk-in on 144.300 simplex link 223.600 repeat, and 445.225 repeat. Call *Steve Greenbaum WB2KDG, nights, at 718-898-5599 or Arnie Schiffman WB2YXB at 718-343-0172* or write *Stephen Greenbaum, 85-10 34th Ave., Jackson* Hgts., *New York NY 11372.* (Rain Date Oct 16)

SYRACUSE NY
OCT 15

The Radio Amateurs of Greater Syracuse will hold their 33rd Hamfest in the Arts and Home Center at the New York State Fairgrounds from 9 AM to 5 PM. Tech-talks, contests, entertainment, giant indoor flea market ($6 per table), commercial vendors. Tailgating area ($3 per car). Admission, $4. Pre-register for FCC exams by October 7. Send SASE if you need Form 610. Talk-in on 146.31/.91 and 147.90/.30. For more information, call *Ed Swiatlowski WA2URK, at 315-487-3417 or*

Viv Douglas WA2PUU, at 315-469-0590 or write *RAGS, PO Box 88, Liverpool NY 13088.*

ROCK HILL SC
OCT 16

The York County ARS will hold their 37th Annual Hamfest at the Joslyn Park, Museum Road. Admission, $3 in advance or $4 at gate. Talk-in on 147.03/6.43 MHz. For tickets or information, contact *Frank Bateman N4HRP, PO Box 4141 CRS, Rock Hill SC 29731.*

WEBSTER NY
OCT 22

The Xerox Amateur Radio Club will operate KE2T from 000Z to 2400Z to commemorate the 50th Anniversary of the Invention of Xerography by Chester Carlson. Phone operation will be in the lower 25 kHz of the general 80, 40, 20, 15, and 10 meter bands, and the Novice portion of the 10 meter band; CW, 50 kHz above the lower band edges. For certificate, send QSL and a business-size SASE to *XARC, Building 337, Joseph C. Wilson Center for Technology, 800 Phillips Rd., Webster NY 14580.*

KALAMAZOO MI
OCT 23

The Southwest Michigan Amateur Radio Team and the Kalamazoo ARC are sponsoring the 6th annual Kalamazoo Hamfest at Kalamazoo Central High School. Sellers set up at 6 AM. Doors open at 8 AM. Talk-in on 147.64/.04 repeater. Forums, walk-in VE testing at 9 AM. Admission $3, $2 in advance. Tables, $6. Send requests and payment before October 1 to *Gary Hazelton KB8PL, 67332 32nd St., Lawton MI 49065.* Checks payable to Kalamazoo Hamfest.

LONDON ONTARIO
OCT 23

The London Amateur Radio Club Fleamarket will take place at the Pot of Gold Bingo Palace from 9 AM to 2 PM. Admission is $3, vendors $4/table. Talk-in on VE3LAC 147.66/147.06. Contact *London Amateur Radio Club, PO Box 82, Station B, London Ont. N6A 4V3. %Dave Noon VE3IAE; 519-453-2292.*

GRANDVIEW MO
OCT 29

The Southside ARC is sponsoring its Hamfest at the Grandview Jr. High from 8 AM to 4 PM. Swap tables, $7 (includes 1 ticket); exams, seminars. $2 per ticket, four for $5 in advance, three for $5 at door. Talk-in on 147.72/.12. Contact *Southside ARC, PO Box 1142, Grandview MO 64030 or call Walt NBØE; at 816-763-9637.*

MINNEAPOLIS MN
OCT 29

The Minnesota Hamfest & Computer Expo will be at the Hennepin Technical Institute. It will feature guest speaker Roy Neal K6DUE, former NBC Science and Space Shuttle Correspondent. Packet demonstrations, ARRL forum, new and used equipment, giant flea market, VE exams, and a CW contest. Talk-in is on 146.16/.76. Admission $4 in advance, $5 at door. Regarding VE exams, contact *Ron Schulz NAØU, 6308 Peacedale Ave., Edina MN 55424; 612-920-7473.* SASE and check for $4.55. For advance tickets and information, contact *Minnesota Hamfest & Computer Expo, PO Box 5598, Hopkins MN 55343, or call Mike Sigelman KØBUD at 612-542-8450.*

CHATTANOOGA TN
OCT 29–30

The 10th Annual Hamfest Chattanooga Amateur Radio and Computer Convention will be at the Convention and Trade Center. It features exams (apply by Oct. 26), indoor exhibitor and flea market displays (tables $10/day, $15/both days), forums. Free admission. Group rates for lodging. For additional information, write *Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404.* For Exhibitor information, call *Barbara Gregory WA4RMC at 615-892-8889*; for flea market information, call *Terry Davis KB4TZ at 615-886-6812.*

KINGSTON OK
OCT 29–30

The Texoma Hamarama Association is sponsoring the Oklahoma State Convention in conjunction with TEXOMA HAMARAMA '88 from 8 AM to 5 PM on the 29th, and from 8 AM until noon on the 30th. Equipment dealers, flea market, technical forums, ARRL activities, auction, exams, Wouff Hong Ceremony, banquet and dance, QCWA breakfast. Special rates at lodge (call 405-564-2311). For more information, contact *Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261 or call Dave Cox NB5N, at 918-250-2285.*

MARION OH
OCT 30

The Marion Amateur Radio Club will hold its 14th Annual Heart of Ohio Ham Fiesta from 0800Z to 1600Z at the Marion County Fairgrounds Coliseum. Tickets $3 in advance, $4 at door. Tables, $5. Check-in on 146.52 or 147.90/.30. For information, tickets, or tables, contact *Ed Margraff KD8OC, 1989 Weiss Ave., Marion OH 43302; 614-382-2608.*

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13+ wpm–Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

"Courageous"

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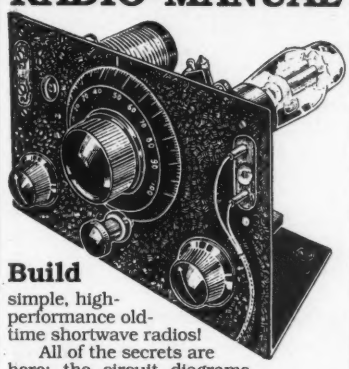

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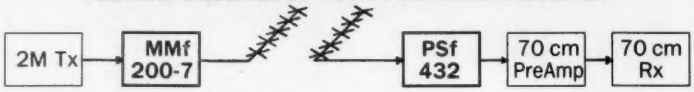

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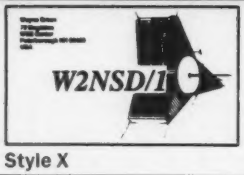

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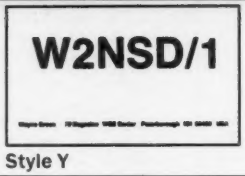

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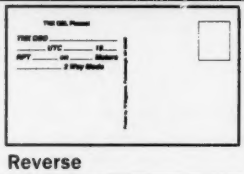
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Work is underway in West Germany on Phase 3D, a more powerful version of OSCAR 13. Phase 3D will resemble a large doughnut over six feet in diameter and three feet thick. In addition to its hamsat duties, it will also be part of the adapter ring to mate an Ariane launcher to its main payload. Launch is expected sometime in the mid-1990s. The proposed orbit will again be highly elliptical, like that of OSCAR 13.

Geostationary Sats

Here in the States, studies have been going on for several years in preparation for the first geostationary, or Phase 4 satellite. Although current designs are very similar to the Phase 3D configuration from AMSAT-DL, the antennas, stabilization and station-keeping systems differ greatly.

Antennas on Phase 3 satellites produce gain perpendicular to the upper surface of the structure. Phase 4 antennas will be yagi and helix types with a perpendicular orientation to the solar panel faces.

While current amateur satellites are spin-stabilized, the Phase 4 series will require a different method. Commercial TV satellites use high-gain dishes aimed at North America. The dish is stationary relative to its target area and the satellite is stabilized with either a rotating body or a flywheel. Both methods are complex and expensive. Phase 4 satellites will be held steady by magnetic fluids pumped through tubing positioned around the satellite's periphery. There will be no moving parts, pumping will be achieved electromagnetically.

Small steering jets will keep the satellite positioned above a specific point on the equator. All geostationary satellites require them. They are used to place the satellite accurately and to counter drift relative to the earth's surface. The jets are designed to have sufficient propellant to allow the satellite to be moved to new locations around the geostationary belt. Additionally, they provide station-keeping for the expected life of the satellite. Phase 4 will require only sufficient fuel for initial positioning to maintain orbit for the satellite's lifetime.

Unlike the commercial TV satellites beaming only at the United States, a single Phase 4 satellite in the proper position will provide access to anyone who can "see" it. The first will likely be placed over the mid-Atlantic for hams in North and South America, western Europe, and parts of Africa. To a ground observer, the Phase 4 satellite will always appear as a stationary object in the sky with beam antennas aimed earthward.

Back To The USSR

On other fronts, new RS satellites from the Soviet Union are anticipated. Look for the launch of RS-12/13 during the summer of 1989. It will be similar to RS-10/11 with modes A (two meters up and 10 meters down), K (15 meters up and 10 meters down) and T (15 meters up and two meters down). A new more advanced RS (14?) is also in the works. Although launch is not expected until the early 1990s, its transponder package will be ambitious. Several modes are expected with B (70 cm up and two meters down), J (two meters up and 70 cm down) and others yet to be defined.

Here in the western hemisphere a new short-term program is underway to build four small satellites for launch in late 1989 by Arianespace. They will be secondary payloads with the French SPOT-2 mission. AMSAT North America reports that the orbits will be sun-synchronous, like UoSAT's 9 and 11, with a 98.7 degree inclination and an altitude of 822 kilometers.

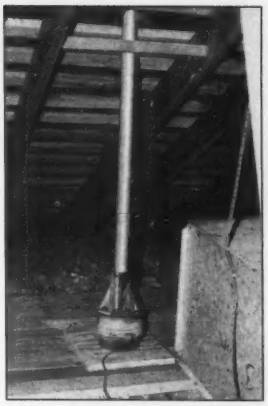

Photo B. The azimuth rotator went in the attic with a 2 x 8 between the rafters for a thrust bearing.

Get On The Stick

Many an AMSAT Area Coordinator has heard the words, "I'll wait for you guys to get a satellite up with the right orbit," or, "When you get a geostationary satellite in orbit I might get interested." Now is the time to get involved.

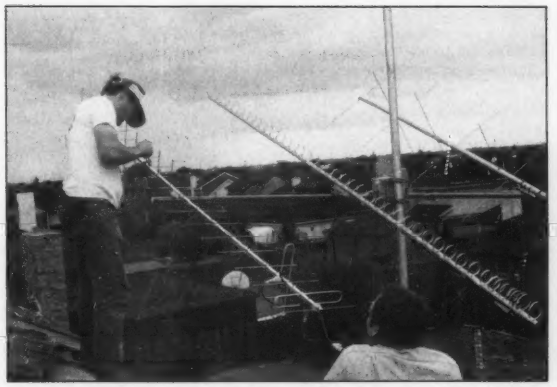

Photo C. WA5ZIB and WA5WOD fine tune element alignment on the 70 cm antenna.

The U.S., Argentina, Brazil, and Canada are involved in design. Two of the satellites are to carry packet radio store-and-forward systems (U.S. and Argentina), one will have a downlink-only voice synthesizer (Brazil) and the fourth will carry a low-resolution CCD (charge-coupled device) TV camera from CAST, the Center for Aerospace Technology, at Weber State College in Ogden, Utah.

The satellites have been dubbed "microsats" due to their small size (9 inches on a side) and low weight (typically 22 pounds each).

Construction has begun in Boulder, Colorado. The microsat program continues AMSAT's nearly 20-year tradition of sponsoring small amateur radio payloads.

There has never been a better moment for amateur satellite activity. OSCAR 13 is the embodiment of a decade-old program to place a hamsat into an orbit favoring the major population centers of the world. Although tentative launch dates are available for all of the satellites of the future, delays occur. Our space shuttle program is evidence of unforeseen pitfalls and their unfortunate effects and interruptions. Looking forward to the endless possibilities of future amateur satellites is fine, but experience with today's satellites is a prerequisite.

RS-10/11, Fuji-OSCAR 12, OSCAR 10, and OSCAR 13 have sev-

Continued on page 69

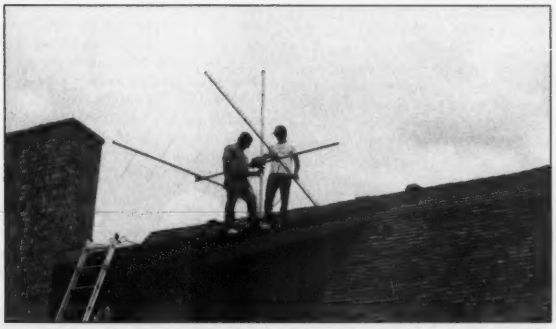

Photo A. WA5WOD and WA5TWT begin installing antennas along the fiberglass boom.

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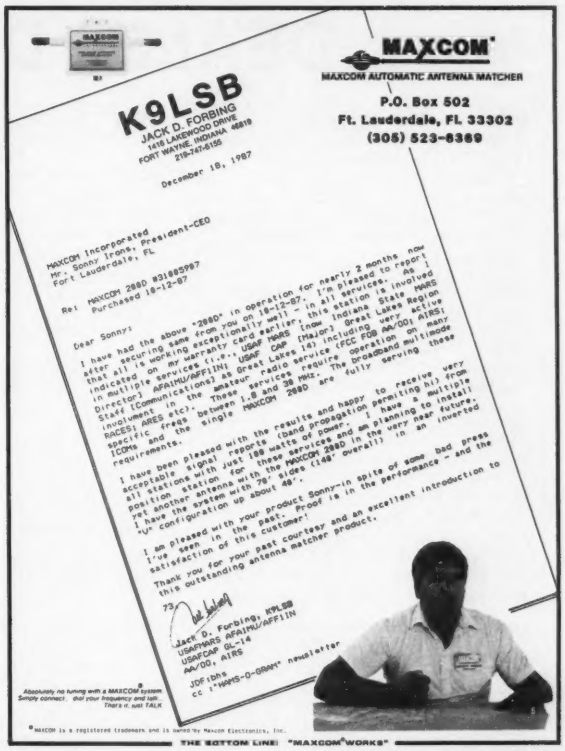
KENWOOD 430s OWNERS! Stop Scan stops the scanner on busy frequencies resumes scanning automatically after an adjustable 1–10 second delay. SASE for 1989 catalog. $19.95 kit. $29.95 assembled. $3.50 shipping. JABCO ELECTRONICS, R1 Box 386, Alexandria, IN 46001. BNB794

VOICEGATE communications noise reduction with audio squelch, noise reduction, VOX cassette recorder control, 3 adjustable audio filters, & more! SASE for 1989 catalog. $3.50 for demo tape. $109.95 complete (till 1/1/89). JABCO ELECTRONICS, R1 Box 386, Alexandria, IN 46001. BNB795

COLLINS KW-S1 TRANSMITTER AM-SSB-CW serial #101 1000 watts working condition. Sell or trade for best motorcycle offered. Bill Miller, PO Box 441, Lowell, AR 72745. 501-659-0982. BNB796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December 18, 1987
MAXCOM Incorporated
Mr. Sonny Irons, President-CEO
Fort Lauderdale, FL
Re: MAXCOM 2880 #31885997
Purchased 12-12-87
Dear Sonny:
I have had the above "2880" in operation for nearly 2 months, now
I'm pleased to report
that all is working exceptionally well in all services. As
indicated on my warranty card earlier, this station is involved
in multiple services (i.e., USAF MARS [Major] Great Lakes Region
Director) AFA1NU/AFF1IN; USAF CAP [Major] Great Lakes Region
Staff Communications) as Communications Officer (16) including very active
involvement in the amateur radio service (FCC FOB rev/001 mode
specific AREC etc). These services require the broadband multimode
RACES; ARES etc), between 1.8 and 30 mhz. The 2880 are fully serving these
ICOMs and requirements.
I have been pleased with the results and happy to receive very
acceptable signal reports (band propagation permitting his from
all stations with just 100 watts of power. I have a multiple
position station for these services and am planning to install
yet another antenna with these MAXCOM 2880 in the very near future.
I have the system up about 40'.
"U" configuration with 70' sides (140' overall) in an inverted
I am pleased with your product Sonny--in spite of some bad press
I've seen in the past. Proof is in the performance - and the
satisfaction of this customer.
Thank you for your past courtesy and an excellent introduction to
this outstanding antenna matcher product.
73
Jack D. Forbing, K9LSB
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CIRCLE 101 ON READER SERVICE CARD

Continued from page 67

eral transponders with many hours of operating time each day. Choose from the basic low-orbit mode A work on RS-11, to the highly technical RUDAK, the German packet-radio experiment using mode L frequencies (23 cm up and 70 cm down) on OSCAR 13.

In the middle ground are the VHF/UHF modes (B and J) on OSCAR 13, which are favored by most current and potential amateur satellite enthusiasts. It is important to find radios and antennas to operate on these modes.

Just a look at the advertisements in this magazine, or any other amateur radio publication, reveals many types of VHF and UHF all-mode transceivers. There are options with power output levels ranging from ten to nearly 100 watts and features from the no-frills basic mobile rig to complex bells-and-whistles base stations. For the majority, the problem is to find the most rig for the least money.

My own system consists of older HF rigs used with transverters and power amplifiers. About 100 watts is available for the VHF and UHF uplinks. Preamps include GaAsFET, MOSFET and bipolar versions, depending on the band and incoming signal levels. When atmospheric or man-made noise is high, however, a preamp is much less useful—it amplifies all incoming signals, including the noise.

"Phase 4 satellites will be held steady by magnetic fluids pumped through tubing around the satellite's periphery."

An uncomplicated setup and easy to operate components are key factors for enjoyable satellite chasing. My station includes many electronic boxes, but it's easy to use.

Keep feedlines short to provide low loss. Belden 9913 provides the best cost-effective approach.

Several individual antennas or OSCAR antenna packages are available from manufacturers. Names to look for include Cushcraft, Telex/Hy-gain, and KLM/Mirage. While the Cushcraft antennas do not include polarization switching or complete stainless-steel hardware, they are the least expensive. The KLM/Mirage antennas, especially the 22C for two meters and the 40CX for 70 cm, provide all the gain and features needed, but the price is high. Telex/Hy-gain satellite antennas are perhaps the "best buy" since they have switching and the stainless hardware, but at a more palatable price.

With my recent move, a change of antennas was in order. Deed restrictions would not allow a large array. I got one of the new antennas in a trade and bought a second for a good price at a swap-meet. The system includes a 14 element crossed yagi for two meters by KLM, a 38 element crossed yagi for 70 cm by Tonna, and a 45 element horizontally polarized loop yagi for 23 cm from Down East Microwave. The two-meter antenna has circularity switching but the 70 cm antenna is hard-wired for right hand circular to agree with most transponders in the sky. Transmission line on all bands consists of 50 foot runs of 9913. Although changes will be needed for the mode L uplink, the rest of the system is performing remarkably well on OSCARs 10 and 13.

My signals through mode L are very weak. Power output to the 9913 coax is about eight watts. Improvements will include a small linear amplifier (30 to 40 watts), better feedline (⅞ inch Heliax) and a crossed yagi tuned to 1269 MHz. The current loop yagi was built for 1296 MHz. I may realize a ten dB improvement with these changes. In the meantime, I will settle for excellent DX and some great contacts through modes B and J via the highest repeater around. 73

DEALER DIRECTORY

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Burbank

New HAM store open and ready to make a DEAL. We carry all lines, ship UPS, and are open Sunday. **A-TECH ELECTRONICS, 1033 Hollywood Way, Burbank CA 91505; (818)845-9203.**

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Hard to find parts, surplus electronics, standard line items. Hams, hobbyists, industrial professionals—from nuts & bolts to laser diodes...Electronically speaking, Gateway's got it! M-F 9-5:30 Sat. 9-5. **GATEWAY ELECTRONICS, 4633 Convoy St., San Diego CA 92111; (619)279-6802.**

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Honolulu

Kenwood, ICOM, Yaesu, Hy-Gain, Cushcraft, AEA, KLM, Tri-EX Towers, Fluke, Belden, Astron, Etc. **HONOLULU ELECTRONICS, 819 Keeaumolu Street, Honolulu HI 96814; (808)949-5564.**

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MISSOURI

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Electronics Supplies for amateurs. Ten-Tec, Barker and Williamson, Cushcraft, Hustler, etc. **ATKINSON AND SMITH, 17 Lewis St., Eatontown NJ 07724 (201) 542-2447.**

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Finally a ham store in NJ. Located ¼ mile south of Rt. 3. Mon.-Wed. 11:30-7:30, Thursday 11:30-9, Friday 11:30-7:30, and Saturday 9-3. Visa/MC. **ABARIS SYSTEMS, 276 Oriental Place, Lyndhurst NJ 07071; (201)939-0015.**

Park Ridge

Bergen County's oldest and only SWL/Amateur dealer. Specializing in HF receiving systems, antennas, ham/SWL accessories, books. Kenwood, JRC, Yaesu, Icom. 1 mile from Garden State Parkway Exit 172. Tu-Fri 10-5; Sat 10-3. **GILFER SHORTWAVE, 52 Park Avenue, Park Ridge, NJ 07656; (201) 391-7887.**

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Western New York's finest amateur radio dealer featuring ICOM-Larsen-AEA-Hamtronics-Astron. New and used gear. **VHF COMMUNICATIONS, 915 North Main St., Jamestown NY 14701, (716)664-6345.**

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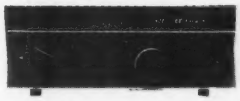

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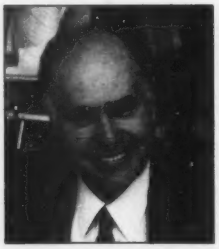
CIRCLE 295 ON READER SERVICE CARD

Getting Rich In The Ham Market



Every time two hams get together at least one says how about if we were to make this great product to sell to hams—not realizing that the ham "industry" is probably one of the best possible ways to guarantee poverty.

No, not all hams are cheap—not all are living on starvation retirement payments—the fact is that some ham firms are doing remarkably well selling to those few hams who are alive and well—and to the handful of newcomers who blunder into our hobby.

The whole trick to survival in the ham market is in getting your sales message to your potential customers—this is called marketing. Marketing includes making sure your literature is as good as (or even better than) your product—and that your sales pitch reaches those few live hams who are your best potential customers.

I'll bet you thought I was never going to mention *73*. Advertising is going to be one of your biggest sales expenses, so give it the serious thought it rates. Advertising is a very well-developed art—billions have been spent on research to find out what works and what doesn't. Indeed I'm working on a video just on how to advertise. In the meantime, if you can take it, I'll mercilessly criticize your literature and your ads—a service no other ham magazine can provide at any price because none of them have anyone with anything even remotely like the 35 years I've had in advertising to hams. Unless you fall into it, it's unlikely you're going to find an ad agency able to help you sell to hams—which is, to be kind, a unique group.

Presuming that sales are of some importance to you, where do you think you'll do best? There are four ham magazines—one for advanced builders—one for contest fanatics—one for ARRL fans—and then there's *73*—which appeals to active hams with small construction projects, with the only world DX column, with columns and news about all of the new ham activities such as packet, RTTY, Oscar and so on. The *73* readers buy circles around other magazine readers because they're active and motivated.

So if you decide to try and fight the odds with a ham product, give it your best shot with *73*—and let me help you win with powerful, sales-oriented literature and ads. A little mail order business at home is a great way to become independent—millions are doing it. Remember, small business is the real strength of America. . . and it's about the only practical way to have a crack at making big money these days.

Write or call the *73* advertising people—Richard, Ed, or Jim—and let's get you started with power ads which will make you money.

. . . Wayne
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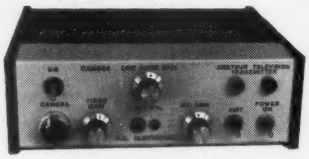

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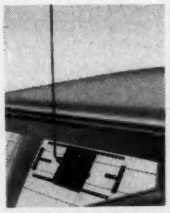

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CIRCLE 163 ON READER SERVICE CARD

ATV

Ham Television

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Vertical Vs. Horizontal Antennas

A few years ago, four of us stunned the ATV (Fast Scan) establishment with the announcement of some serious experimentation and testing work of Alford Slot UHF 70 cm antennas. The experiments and tests were conducted by Merle Reynolds W9DNT of the BRATS Iowa/Illinois ATV Club, Gerald Cromer K4HNH, and Hap Griffin WA4UMU of the Palmetto, South Carolina, ATV Club. Over the past few years, we have all taken a lot of comments like "it can't be done," "your testing is very misleading," or "there are no horizontally polarized, omnidirectional antennas with gain, but there are a lot of 10 dBd vertical ones." The last one is our favorite west coast comment that keeps our spirit for this challenge alive.

The arguments over the years about vertical versus horizontal antennas were hashed over many times. The mention of this subject usually stirs quite a controversy. W9DNT, K4NHN, and WA4UMU decided to quit talking about it and start doing something about it! Nearly three years later, after a lot of hard researching, building and testing, ATV horizontal "slots" are now popping up all over the place on ATV repeaters and remote transmitter systems (Sumter, Davenport, Minneapolis, Philadelphia, Kansas City, Central Texas, Oklahoma, Connecticut, and elsewhere). Even ATV simplex and 432 MHz SSBers have taken a shine to these unusual antennas. Measured testing on calibrated equipment and proper test ranges rate these antennas (dual-stacked models), at 7–10 dBi. These gain figures favorably compare to, and in some cases actually out-shine, those of amateur vertical ground-plane "omni" systems. The slots radiate a toast shape, near-omni pattern, with side loss rejection measuring less than 1 dB down. There's a little bit more forward gain on the front end or slot opening of the array than on the back. These home-brew antennas run anywhere from $20 to $40, depending upon the length and materials used. The solid-wall "infinite halo" slots designed by W9DNT are the most ruggedly built of the slots, and so can survive tower icing conditions far better than any amateur ground plane product. K4NHN's rib-caged slots are taller, lighter, and have more gain on single array versions.

Over the past few years, *The Spec-Com (USATVS) Journal* featured quite a few articles on the slot design for ATV operation. The special fifty-page Alford Slot theory and design information is available (thanks to K4NHN) in the *ESF Copy Service's #109 UHF Antenna Reprint Booklet* for $10 (4015 Clearview Drive, Cedar Falls, Iowa 50613). An extensive technical article by Hap Griffin WA4UMU describing testing procedures for Slots appeared in the June 1988 issue of *Spec-Com*. The antenna designs by W9DNT appeared in the May 1988 *Spec-Com* issue.

3.5" 70 cm Single or Dual Slot

The new 200Ω impedance 3.5" diameter Alford Slot antenna for ATV/SSB is made out of galvanized tin gutter or stovepipe metal. The single array is only 5' tall, with a circumference a little over 11." A ½" slot opening is recommended. A 4-to-1 coaxial balun taken from the *ARRL Antenna Handbook* brings the 200Ω impedance down to 50Ω. Use the formula: "492 divided by (f), times 12", times coax velocity formula" to determine the connection harness (439.25 MHz will end up being about 10"—421.250 MHz at 11"). RG-8X is used on this model, with Belden 8214 for the longer section. Dual-stacking a pair of these antennas gives more gain, and you can use a common T-splitter to join the two antennas. Coaxial feedpoint is located in the center of the antenna. Brass shorting bars are used to electrically terminate antenna radiation. Support is added as PVC ring collars. The entire array may be incased in PVC or plastic/rubber corrugated tubing. Seal the slot opening to prevent howling or whistling. Coat the entire antenna with Tenna Cote™ or similar protective finish coating.

Smaller, Lighter 902–928 MHz Design!

At the request of several FSTV individuals who voiced their requests at the 1988 Dayton ATV Workshop sessions, W9DNT built, in just a few hours, a completely new smaller and lightweight "dual" 900 MHz Slot antenna array. This new antenna covers the entire 902–928 MHz frequency range. With the use of a large umbrella, these two joined (200Ω), "single" Slots give good gain at about half the price. Those of you beginning to play with 900 MHz, or building a 900 MHz ATV repeater input or output, should take a good look at what Merle has achieved! The same U-shaped coaxial balun is used as on the 3.5" 70 cm Slot, only now the length is around 5". There is a 2¼" gap between the two antennas. The slot opening is ⅜"

These antennas should be mounted as the "top most" antenna on the structure or tower. Don't use a side-arm bracket mount, as that will cause the radiation pattern to distort toward the tower. Keep the antenna at least 2 or more feet away from the supporting structure. Contact Merle Reynolds by writing to him at 710 25th Avenue Court, Moline, Illinois, 61265 or by calling him (no collect calls accepted), between noon and 9 PM at (309) 764-1685.

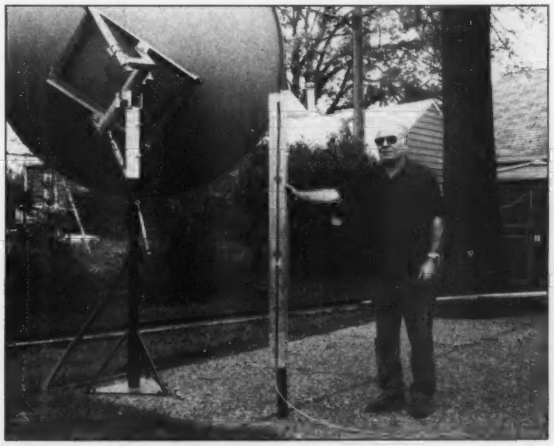

Photo A. Merle Reynolds W9DNT holding an Alford Slot antenna.

As the popularity of the ATV mode continues to grow, more ATV repeaters and remote transmitters (weather radar), will be coming on the air. It's important to first recognize the established antenna plane of operation in your own area. If it is vertical, then by all means stay upright. If it is predominantly horizontal, then, thanks to W9DNT, K4NHN, WA4UMU and others, there are no longer any excuses for not building a horizontally polarized ATV repeater system!

QRM Relief?

While some ATV groups continue to fight and hold out at all costs against the previously mentioned horizontal antenna polarization standardization move, others are learning of a rewarding, no-cost, 20 plus dB FM QRM isolation method! Take my favorite problem target group in the Indianapolis area. They have a vertical on their repeater system on a tall State Police Tower, just south of town and have, because of terrible FM repeater QRM problems, retweaked their repeater's sideband product to accept the LSB audio sub-carrier instead of the upper. The Omaha, Nebraska area has done the same and, in fact, got this procedure entered in the regional FC policies. Both cities could benefit even further by building a W9DNT Slot—this would give them an additional 20 dB of isolation and get them on the same DX plane with the rest of the world! (TV video duplexers are now available from TX/RX and other manufacturers of single-antenna array systems.) The fellas on the Indy ATV repeater seem content year after year working a limited number of people over a limited number of miles.

We are now receiving the logsheet results of last month's USATVS sponsored 7th Annual "North American Fast TV UHF QSO and DX Contest!" Stay tuned for the results! We had a great activity turnout and some "long hauls!" 73

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson, AZ 85541

Propagation Forecast

HF propagation conditions during the month of October should be better than average due to seasonal upswings in solar activity without the excessively high absorption levels of the summer months. The sunspot numbers continue with the rising of Cycle 22, and the still almost-equal numbers of daylight and darkness hours contribute to excellent HF propagation. You may find that geomagnetic field disturbances will ruin some otherwise good days, so a constant check of WWV at 18 minutes after the hour will keep you apprised of changes in solar flux values and geomagnetic field conditions. Once again, look for solar flux values of 150 or higher. The higher the solar flux and the lower the A index, the better propagation will be.

You will want to look at two specific areas of the accompanying charts: the *daily* letters G=Good, F=Fair, and P=Poor; and the trends, such as F–P, for example, which means Fair conditions trending to Poor. The second area to be aware of is the MUF, or maximum usable frequency. Our charts show which bands are expected to be usable from one part of the world to another, and what time to expect these openings. On a day where "P" conditions prevail, it is unlikely that you will be able to contact Timbuktu at a band and time when there are no expected openings to Africa. On the other hand, when a "G" symbol is given for a particular day, and when openings are anticipated at a certain time to a particular area of the world, it would be very beneficial to keep the receiver sharp-tuned for DX signals from the indicated areas.

If you have a beam antenna of some kind, it may help to pick up the weaker signals from early band openings. Even on "Good" days, you can't always expect to hear exotic calls roaring through the loudspeaker or earphones. Patience, and an ability to dig out the weak signals, will prove to be assets. That DX station may be one that has a poor antenna and a very low-power transmitter!

Be aware of excellent possibilities just before dark and just after dawn—the so-called "gray-line DX" opportunity. Signals seem to propagate particularly well along the earth's line of darkness as it approaches any given area. Perhaps not so obvious is the fact that as darkness advances in one area of the world, it retreats in another, and these two areas may be accessible to one another by propagation of HF signals. Quite often, signals propagated along the "gray-line" have unusual strengths at the receiving end. Also, these signals may arrive from unexpected directions, compared to signals received during either the daylight or darkness hours.

We have discussed DX and "long-skip," multi-hop propagation in these pages almost to the exclusion of the "other" type of propagation called "short skip." It might be worthwhile to talk just a little about short skip opportunities; that is, the propagation of signals over distances of approximately 100 to 2500 miles.

This type of propagation occurs mostly in single-hop, rather than multi-hop, stages and may be predominantly F_2-layer propagation, at least on frequencies above 14 MHz. Short skip usually begins with shorter distances in the morning hours increasing to longer distances in the darkness hours before midnight local time. Short skip propagation can be useful if you know where and when to look, and also for the purpose of "keeping a sked" with a friend in another part of the country. Looking at it in another light, you can think of DX as "long skip" and everything else as short- or medium-skip propagation. It is probably best to discuss short skip in terms of a band-by-band summary, beginning with 160 meters and ending with 10 meters. During the days when conditions are generally listed as "Good" or "Fair" in our calendar, skip distances will change with time and frequency. On "Fair" or "Poor" days, you may not be able to work any short skip at all.

To use short skip, consider the midpoint of the path between any two locations. The local time at the midpoint determines the time at your end of the path and at the other end of the path, when the short skip path crosses several time zones. 73

See next month's column for examples on how to use the charts to determine short skip.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	–	–	–	20	20	–	–	–	15
ARGENTINA	20	20	40	40	–	–	–	–	–	10	10	15
AUSTRALIA	15	–	20	–	–	40	20	20				15
PANAMA	15	20	40*	40*	40	–	20	20	20	10	10	15
WESTERN EUROPE	40	40	40*	40	–	–	20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20	–	–	10	10/15
INDIA	–	–	–	–	–	–	20	20	–	–	–	–
JAPAN	15	20	–	–	–	–	20	20	–	–	–	15
MEXICO	15	20	40*	40*	40	–	20	20	20	10	10	15
PHILIPPINES	–	–	–	–	–	–	20	20	–	–	–	–
PUERTO RICO	15	20	40*	40*	40	–	20	20	20	10	10	15
SOUTH AFRICA	20	–	–	–	–	–	–	–	15	15	10	20
U. S. S. R.	40	40	–	–	–	–	–	15	15	20	–	–
WEST COAST	40	80	–	–	–	–	–	20	20	20	15	40

CENTRAL UNITED STATES TO:

ALASKA	15	–	–	–	–	–	–	–	–	–	–	15
ARGENTINA	15	20	20	40	40	–	–	–	–	–	10	15
AUSTRALIA	15	20	20	20	–	40	80	–	–	–	–	15
PANAMA	15	20	20	40*	40*	–	–	15	15	10	10	15
WESTERN EUROPE	–	40/80	40/80	–	–	15/20	15	15	20	20	20	–
HAWAII	15	20	20	40	40	40*	80	20	–	–	10	15
INDIA	–	–	–	–	–	–	–	20	–	–	–	–
JAPAN	15	–	–	–	–	–	–	–	–	–	–	15
MEXICO	15	20	20	40*	40*	–	–	15	15	10	10	15
PHILIPPINES	15	20	–	–	–	–	–	20	–	–	–	–
PUERTO RICO	15	20	20	40*	40*	–	–	15	15	10	10	15
SOUTH AFRICA	20	–	–	–	–	–	–	–	–	15	15	20
U. S. S. R.	–	–	–	–	–	–	–	20	15	20	–	–

WESTERN UNITED STATES TO:

ALASKA	10/15	15	15	20	20	20	40	40	–	–	–	15
ARGENTINA	10/15	20	20	40	–	–	–	–	–	–	15	10/15
AUSTRALIA	10	15	15	20	20	40-	40	40-	20	20	15/20	15
PANAMA	20	20	40/20	40/20	40	–	–	20	15	15	10	10
WESTERN EUROPE	–	–	–	–	–	–	–	–	–	15/20	15/20	–
HAWAII	10	15	20/15	40	40*	40*	40	40	–	20	20	20
INDIA	15/20	15/20	–	–	–	–	–	–	20-	–	–	–
JAPAN	10/15	15	15	20	20	20	40-	40-	–	–	–	15
MEXICO	20	20	40/20	40/20	40	–	–	20	15	15	10	10
PHILIPPINES	15/20	15/20	–	20-	–	40-	40-	–	20	20	–	15
PUERTO RICO	20	20	40/20	40/20	40	–	–	20	15	15	10	10
SOUTH AFRICA	20	20	–	–	–	–	–	–	–	15	15	20/15
U. S. S. R.	–	–	–	–	–	–	–	–	20	–	–	–
EAST COAST	40	80	–	–	–	–	–	20	20	20	15	40

OCTOBER 1988

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G	3 G	4 G	5 G–F	6 F–P	7 P	8 P
9 P	10 P	11 P	12 P–F	13 F	14 F	15 F–G
16 G	17 G	18 G	19 G	20 G–F	21 F	22 F
23 F–P	24 P	25 P	26 P–F	27 F–G	28 G	29 G
30 G	31 G					

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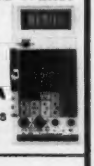

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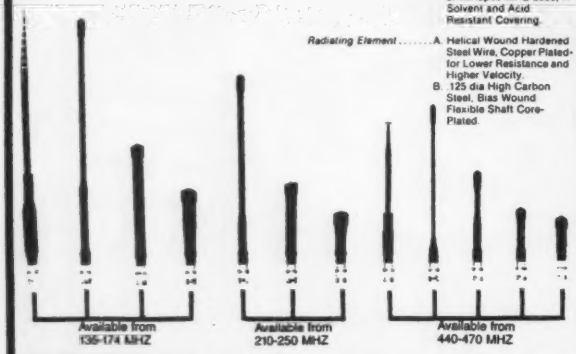

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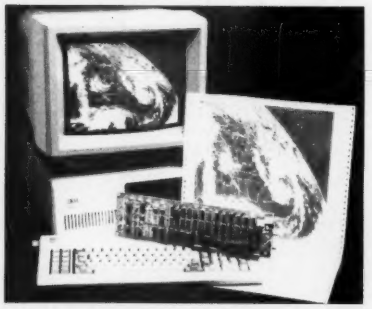

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by Vince Coppola N1VC

After a few years of receiving quality pictures on old surplus weather recorders, I got tired of their many problems, including balkiness, foul odors, and expensive paper. My thoughts led to digitizing the picture with a microcomputer.

This project, which I took on about 5 years ago, was developed on an S-100 bus system. My board would display an image of 256 pixels horizontal, by 128 pixels vertical, by 16 gray levels. It did not take long to fill up a board with RAM chips and other components to achieve this size image, nor did it take long to exceed my budget. With the technology of even just a few years ago, I was unable to duplicate the nice quality pictures I was getting from my old boat anchor recorders.

Recently, I saw the specs on the Imagewise board developed by Circuit Cellar 1, with 256 horizontal, by 244 vertical, by 6 bits. This could double the vertical area of my picture and increase my gray scale to 64 levels. This should improve my picture quality, getting rid of jaggedness on certain details caused by digitization. Another nice feature is that it is driven by a serial port. I could connect the display board to any computer I wished, as long as it had an RS-232 port.

One candidate was my CoCo II which already had a built-in A/D converter. I choose my IBM AT clone, however, because it has much more memory, and the Imagewise drivers and image processing routines were already available from Circuit Cellar. The only thing I needed was a 6-bit A/D board with a parallel port that would allow me to sample at about 100 microseconds. I came up with the design in Figure 1. I settled for an 8 bit A/D just in case I needed it for a future project that would yield 256 gray levels. The 100 microseconds is probably overkill, but this will work out very nicely for my next project with the Imagewise board slow scan television.

The article doesn't deal with the details of building the entire station—check out References 2 and 3 for that. (Reference 3 also contains some very useful information for satellite identification.) What I show here is how to send the demodulated video signal and the sync pulses to an A/D interface board in the IBM PC, sample and store them, and send the data out an RS-232 port to Imagewise. Of course, since the image is stored in a disk file, image processing can remove noise, and it's possible also to run an image enhancement program on it, to bring out ground, cloud details, etc. A higher level language, such as "C" or BASIC, handles the gory math.

Refer to Figure 2. The 137 MHz AM signal is received from the satellite, fed into the video demodulator, in this case, also into the RTM CCF-2 board 4. The video output sig-

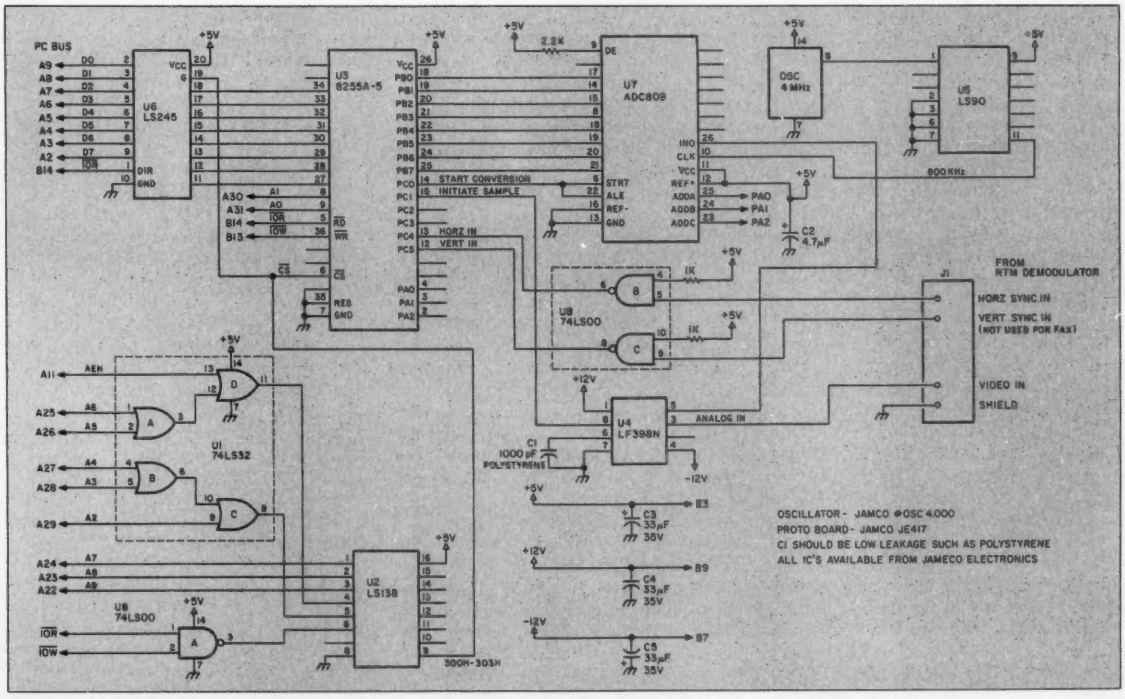

Figure 1. Schematic for the 6-bit A/D converter with a parallel port.

nal is then converted to a 0-to-5 volt signal. Zero volts represents black, 5 volts represents white, and everything in between is a gray level. This is fed into the A/D converter where it is sampled and stored to RAM at fixed intervals by the PC. This is simple so far, but sync information is still needed.

Horizontal Sync Pulse

With a 120 line-per-minute (LPM) transmission rate, the unit receives a line every 0.5 seconds. If we generate an accurate 0.5 second-spaced pulse of about 5 millisecond duration (a standard duration), we can use this as the horizontal sync pulse for telling us when to start displaying a new line. On the RTM board, this .5 sec pulse is derived from the on-board crystal oscillator and also has a circuit built in for manual phasing of the image. What this means is, if the picture is out of phase with the locally generated sync pulse, then we can press this switch down until the view is the way we want it.

Another nice feature of the RTM board is that it allows video storage on a stereo tape recorder.

Now that the horizontal sync pulse has been generated, it is fed into the 8255 port on the A/D board. This tells the program when to store a sync pulse byte (41H) into the stored image file, so the Imagewise receiver board will know when to start a new line . At the beginning of the image in memory, we store a start of Frame byte (40H). This tells Imagewise that a new picture is coming. When we have filled up the 62K with imagery, we place an End of Frame byte at the end (42H). The software automatically saves the 62k image to disk when the image has finished scanning, and invokes SHOW.COM to display the image to Imagewise.

An important point is that the Imagewise file format is not much different from the PIX file format used on the ROBOT 1200. The only differences are the Start of Frame byte, the End of Frame byte, and the new line bytes that are added to Imagewise. John Williams of the Datalink BBS wrote programs that will convert files both ways. It's available for downloading from that source.

Circuit Description

The circuit was designed for the IBM PC bus. The 8255 parallel I/O is the heart of the board, and is capable of reading or writing to three 8-bit ports: 300, 301, and 302. The board is set up to be used in the prototype area of the PC and uses ports 300H–303H. Port 303H is where the configuration byte or control byte is stored for the 8255. Ports A, B, and C correspond to locations 300H–302H, respectively. Port A is configured as an output port, port B as an input port, and Port C is split up into both input and output ports. The Port C output lines control the sampling, and the A/D conversion of the video input line. When the conversion is done, the 8-bit byte is read into Port B on the 8255. The input lines of port C read the sync input lines (only horizontal sync in the case of FAX). Port A is used to select which input line of the A/D converter we are going to sample (line 0 in our case).

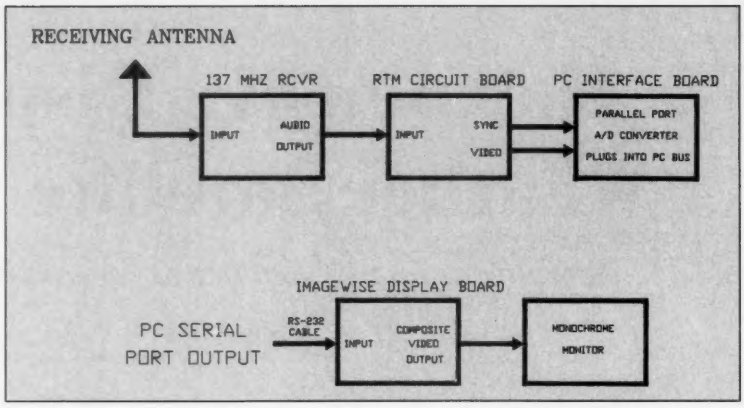

Figure 2. Flowchart for the WEFAX image reception, digitization, and display.

The clock for is supplied by an on-board oscillator. I could have stolen it from the PC bus, but doing it this way, the software becomes compatible with computers of varying clock rates, such as turbos and ATs.

Construction

The prototype was built on a short slot type wire-wrap proto board available from Jameco. The board comes without a mounting bracket. I felt that it was desirable to have one, so I mounted some homemade brackets on it, and punched a hole for the connector to the RTM board. I used a D-type connector for simplicity. Simplicity and easily obtainable parts were two objectives of this design. Placement of the parts is really not critical, but bypass capacitors of the .1 µf disc ceramic type should be placed from the 5 volt bus to ground, as close as possible to each IC on the board. I would also advise ohming out the entire circuit before plugging it in. The half hour or so you may spend in doing so may save you hours of troubleshooting. I also suggest placing the board into the PC and measuring certain points for the correct voltages before installing the ICs. This will also likely save you much trouble.

Checkout

Before trying to receive FAX, check out the video input port. Place a known DC voltage in the range of 0–5 volts on the video line. Next, insert the program disk into Disk A, and type MENU0. When the menu comes up, type a "V" to observe the voltages that print out continuously on the screen. They should indicate the correct value continuously, with maybe a slight (and negligible) error in the hundredths digit. If all is OK, then hit CNTL-Brk to exit.

You are now ready to hook up the RTM board. It is a good idea to shield these input cables and ground the shield to the PC chassis. Again insert the program disk into Drive A, and a formatted blank disk into Drive B. Type MENU0, and select the type of satellite you want to display. You should select one of the phasing keys at first. Then start the tape. If all is good, then you will see each line being scanned from the top to the bottom of your monitor, and in four colors if you have a color monitor. If no lines appear, then you are not receiving horizontal sync pulses, and you should check your wiring. If the picture has to be phased, you can do so now by holding down the phasing switch on the RTM interface. When all looks good, hit return and you will return to the menu. Now hit the correct key to receive and store the image. When the image is stored, the program will automatically store it to a file on Drive B called IMAGE.PIC. It will then attempt to send it to Imagewise using the SHOW.COM utility supplied by Circuit Cellar. The program will then return to the menu.

Additional Notes

In this article, I attempted to explain a relatively low-cost board that can display excellent results when connected to the above system. Two closing points: the files obtained with my software can be converted to PIX files format as used in the ROBOT 1200. Also available on the Datalink BBS is a program I have downloaded that will display .PIX files in EGA format. These two programs are:

EGA-PIX–Monochrome
EGA-PIX2–Color

The programs work only with 19 gray levels, but the results were pleasing, anyway, when I ran them on some polar orbiting images as well as some WEFAX frames.

References

1. Circuit Cellar—Imagewise display/receiver board partial kit, full kit, or fully assembled and tested. CCI, PO Box 428, Tolland CT 06084. (203) 875-2751.
2. *New Satellite Handbook*—by Ralph Taggart, 602 S. Jefferson, Mason MI 48854.
3 *73 Magazine* December 1984—Color SSTV PART II, by Taggart and Abrams.
4 RTM Circuit Boards, 205 Elm St., Van Horne IA 52346-0400. CCF-2 FAX Interface board.
5 Datalink RBBS—Jeff Wallach N5ITU, chairman. (214) 394-7325.

•Vince Coppola N1VC makes available the software described above on 5.25" disk to run on an IBM PC or compatible. (Note color-graphics board and color monitor are used for phasing.) $22.

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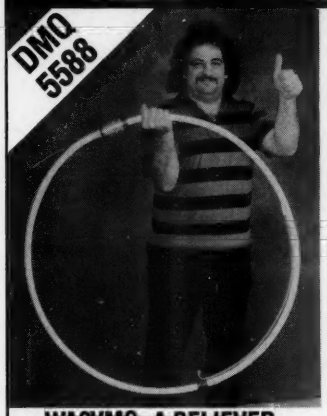

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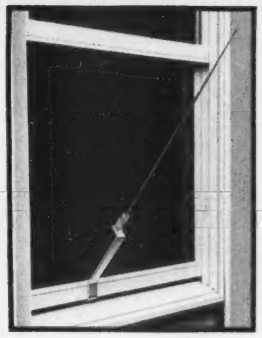

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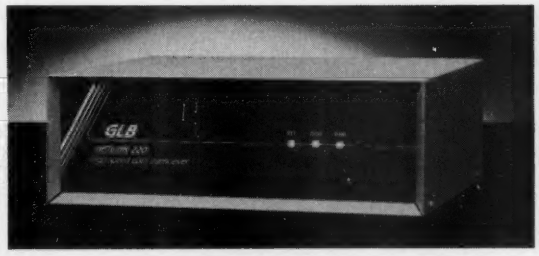

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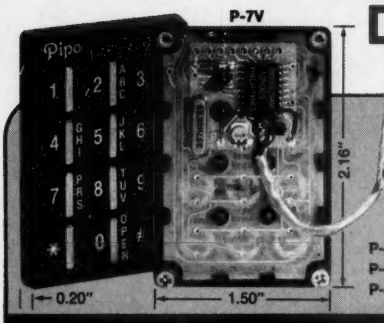

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FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we've decided to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed below. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we'll draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Product Report card and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback#	Title
1	Welcome, Newcomers
2	Never Say Die
3	QRX
4	Packet Full of Pixels
5	Review: Alinco 24T 144/440 MHz FM Transceiver
6	A Trip Through The Microwave Spectrum
7	10 GHz Polaplexer
8	VHF/UHF Tape Antenna
9	Review: SSB Electronics LT-33S
10	Portable Re-entrant Cavity Two Meter Antenna
11	Review: W2DRZ 902 MHz Linear Transverter
12	Pee Wee Thirty Transceiver (Part Two)
13	Passions Of The Ether
14	Antenna Systems (Part Two)
15	Microwave Test Equipment
16	Review: Down East Microwave Model 2345LY
17	Above and Beyond
18	RTTY Loop
19	New Products
20	Review: Motron AK-10
21	Special Events
22	Index: 10/88
23	Hamsats
24	Barter N Buy
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29	Ad Index
30	QRP
31	73 International
32	Errata
33	Letters

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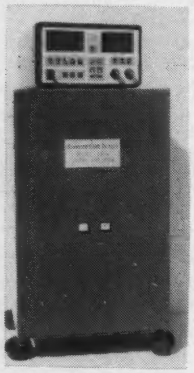

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CIRCLE 342 ON READER SERVICE CARD

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon, OH 44646

I start here with a second look at the vertical antenna. In the past, I've mentioned the ho-hum performance of the vertical antennas I have used. Larry Jones WB5KYK sent me a great letter on the vertical antenna. Apparently, he didn't like my statement that vertical antennas radiated poorly in all directions. Larry has over 29 years of experience in vertical antennas. Follow Larry's field operator's guide to verticals for a good antenna that radiates a good signal in all directions. Larry writes the following:

"So, you want to put up an antenna that doesn't require a tower. Enter the vertical, the stepchild of the antenna family. Or is it? Let's find out what really works at one's QTH and not what works just in theory.

"First understand that the very nature of this beast makes it noisy on receive, so if there is a noise problem, be ready to use a different antenna for reception. This is not much of a problem with verticals on bands above 40 meters. Do not even think about putting up a vertical if it is easier to put up than a beam. Understand that the antennas that we are talking about are those that will work. It is easy to drive a piece of pipe in the ground, bolt on a commercially made vertical, and call CQ. That is the kind of vertical that Mike was talking about. What he didn't say was that the only QTH where these antennas work worth a damn are ships at sea and islands. If that is the kind of antenna project in mind, quit reading right here, sell the QTH, and get a copy of *73* sent to the new QTH.

"Avoid any vertical that has traps in it, especially on QRP. These things make the vertical radiate poorly on more than one band, while they eat up one watt. Nothing like having a poor signal on more than one band from the same antenna! Also, avoid using loading coils at the base of the antenna. If a coil has to be used, make it with big copper (#6) wire. Solder the feedline to the tap point. Don't use some device that is easy to bolt on to the coil, supplied by a friend down the block. Chances are he got it from the vertical he took down that didn't work.

"Where does the vertical go? In the clear. It is that simple. If this can't be done by ground-mounting the vertical, try going up. Once I used a short vertical mounted to the side of a chimney on 160 meters, and it worked great. With this method, be sure that a big copper wire is run to the base of the vertical for grounding. Attach it to a good ground rod. I consider a ground rod of no less that 12 feet to be about the minimum length for above-ground installations. Be sure to run as many radials down to the ground as possible. They don't need to be the same length. I consider 16 to be a minimum number.

"These are not tuned radials, so the formula to determine their length is this: make them reach the ground as far away from the antenna as possible. The wire to make the radials really doesn't matter. Here comes the bad part. In all likelihood, a tuner will have to be used. I suggest any QRP operator get (or build) a good low power tuner. And what about the power loss in a tuner? How many hams are using RG8/U or smaller coax in a QRP operation? Why not use a hardline or 9913? I can't see how anyone could be too concerned about the loss in a properly designed tuner if they aren't concerned with that hamfest special coax. Granted, a little power will be lost in the tuner, but try connecting a power meter to the feedline at the antenna. Don't place it immediately after the tuner, but at the feedpoint. See how much power is actually getting to the antenna without a tuner. It is an illuminating observation.

"If the antenna system is to be permanent, it is always good to have insulated radial wire. Be sure to connect these above-ground radials to the antenna grounding point in an electrically sound manner. This usually means soldering. What is mechanically sound is not always electrically sound.

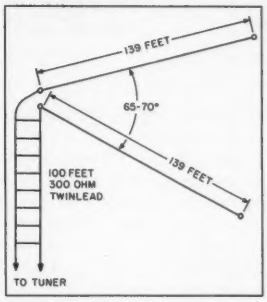


Figure 1. The 20 meter VEE beam.

"If something needs to be bolted to the antenna base for attaching radials, tin the soldering lugs with solder. The vertical antenna builder and user must fight any loss of continuity in his radial system. A cheap way to attach the radials at the end to ground, in above the ground installations, is to use aluminum tent pegs. They are durable as well as cheap. It doesn't matter if the vertical is ground-mounted or above-ground mounted. Tie the radial system into everything that will give a ground, such as chain link fences, arbor wire benches, water pipes, and steel or copper lines.

"The rule for ground- and above-ground mounted verticals is to evenly space the radials as much as possible in a 360 degree circle. Also, ground-mounted verticals should have as many radials as possible. They should be as long as they can be, up to two or three feet longer than ¼ the wavelength on the lowest frequency used. Tie the radials into everything. I highly recommend using a large number of short radials right around the base of the antenna. How short is short? 1/16 of a wavelength will work, but ⅛ is better. If possible, put poultry wire on top of the ground around the base of the antenna. The radials will work fine on top of the ground. If they are buried, don't bury them too deep, especially if operating on 10, 15, and 20 meters.

"The best and simplest vertical is ¼ wavelength long and operates on a single band. A ¼ wavelength vertical cut for 7.1 MHz would only be 32.96 feet tall. A telescoping TV mast pole would work fine for this. Get a cool drink in a glass bottle to celebrate purchasing the TV mast pole and have the base insulator for the vertical. I said that a ¼ wave vertical is the best. Let me state it this way. It is the best when considering cost, ease of installation, and feedline matching. It will work great, but there are other verticals that will out perform it.

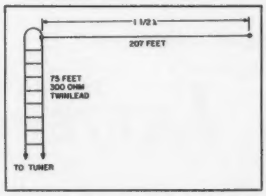


Figure 2. The 40 meter long wire antenna.

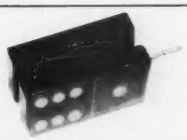
"The vertical, when operating against the proper radial system, is a low-angle radiator. The trade off for good performance at great distances is poorer performance at shorter distances. These antennas do work, and they work well for what they were designed to do—transmit well at great distances.

"At our QTH we have an inverted L (one of the many forms of the vertical) that is ⅜ wavelength long on 1.84 MHz. I have 120 ground radials down, 125 feet long, grounded to what I call my central ground hub: five ground rods, 12 feet long, arranged in a square. I have 150 ground radials that are 18 feet long and poultry wire at the base of the antenna. I'm also tied into various ground sources around the QTH. My vertical radiates equally good in all directions.

"I always enjoy hearing from people who use verticals, and

0073 Spy Key

by Skip Westrich WB8OWM



Here is a very inexpensive homebrew "0073 Spy Key," Mr. Bond. Use two dominoes, a Radio Shack 275-016 micro-switch, a dash (pardon the pun) of epoxy, and you are in business, so to speak. The key works great upright or on its side and tucks away nicely for covert operations.

One last item, Mr. Bond. The key never needs adjustment. With those 5-amp, 250 VAC contacts, this key should "Never Say Die."

So there you have it. Good luck with your mission, Mr. Bond.

Photo A. Alan Pike's quick change antenna setup. Top row for radios, bottom row for antennas.

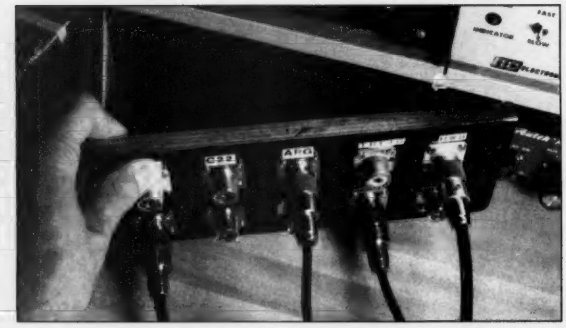


Photo B. Not much to it. Just some female connectors and a piece of plywood.

people who are planning vertical antenna projects. Feel free to drop me a line, SASE please." (Send your comments to Larry and not to WB8VGE.)

Write to Larry Jones WB5KYK, at Rt 12, Box 139C, Laurel MS 39440. Don't forget the SASE!

I've mentioned in the past about all those SWR meters, antenna switches, etc. we manage to put in line. Alan Pike W8MGF has a solution for a multitude of antennas and rigs. After spending a lot of time bent over the rigs, fiddling with coax connectors from this rig to that one, and trying to figure out which coax went where, Alan decided to re-engineer his antenna system.

Alan has an antenna patch panel consisting of two rows of female connectors with quick disconnect patch cables. The panel was made from an old piece of plywood. The labels came from the sheet of pressure sensitive numbers and letters that come with video tapes. The top row goes to rig/tuners. The bottom row is the termination point for his dipoles. Alan says, "It really speeds up changing antennas, and is a lot cheaper than coax switches."

Talk Field Day, and hear all about antennas. Everyone want the ultimate death ray? Here are two antennas that have worked out quite well for the Zuni-Loopers Field Day group. Fred Turpin, Bob Spidell, and Cameron Hartford.

The first antenna, the 20 meter Vee beam, is quite simple. It is two wavelengths of a leg, 139 feet, with an apex angle of 65 to 70 degrees. This antenna was hauled into the pines to a height of 50 feet. The antenna has a gain of about 5.5 dB. The Vee was found to have very low noise characteristics.

The 40 meter long wire antenna is made of 207 feet of wire feed with about 75 feet of 300Ω twinlead through a tuner in end-Zepp fashion. Tuning was broad on 40 meters but sharp on 80 meters.

Next month, I'll continue with the solar power series. After we finish applying solar power to our stations, we'll start building some receivers.

If you write a request and don't send an SASE, you may not get a reply. I can be reached via Compuserve ID# 73357,222. Also, via packet from the KA8Z BBS. Just tell whatever BBS to forward messages to me via KA8Z. 73

Number 33 on your Feedback card

LETTERS

From the Hamshack

Fox Hunting Revival

In Wayne's April editorial, he states that he hopes to get fox hunting revived in the US. I think this is a great idea, though fox hunting is not dead and has already had its own revival.

I can go on a mobile transmitter hunt at least 10 times a month in the Los Angeles area. In San Diego or Santa Barbara, there are additional hunts. These hunts are on 10, 6, 2, and 220. Participation in these hunts has grown 50 to 100 percent in the last five years. We have every kind of hunt you can imagine. Some are simple hunts where the hidden T goes out, hides, and (almost) everyone finds him in the next one to three hours. Others are more specialized.

The predominant style of fox hunting in Europe and Asia has never been popular in the US. With rare exceptions, US fox hunting is mobile, while most fox hunting in Europe is on foot, as a physical sport. The requirement for fox hunting is cross country running.

In a European or Asian fox hunt, it isn't unusual for up to five transmitters to be on the air at the same time, over hundreds of meters of hillside. Winning times of less than an hour are the norm, with the hunter being required to find all five transmitters, sometimes in a specific order.

European style fox hunting would be an ideal activity at Scouting events. This may be a way to get students into ham radio. Inexpensive DF receivers (that could also monitor the local repeaters), can be cheaply built. Building the receiver would give the Scouts experience in electronics while the actual fox hunting would combine radio, the outdoors, and learning skills with a map and compass.

How about a National Scouting Fox Hunting Championship? This would be an ideal way to get non-hams involved, since a license really isn't necessary.

T-hunting, as it is known in our country, has much to offer ham radio. T-hunting is a microcosm of ham radio, combining the camaraderie of a meeting or Field Day, the fun of a contest, public service, and the satisfaction of homebrewing. Anyone can hunt. We have blind hams that do so regularly, using an audio S-meter when turning the beam. T-hunting is a natural for high school students since it combines cars, competition among friends, and electronics.

Thomas N. Curlee WB6UZZ
Fullerton CA

In Appreciation

My husband and I are new to ham radio. I just upgraded to Tech in February, and the group of fellas where I took the test were very supportive and really pulling for me. They made me feel great. I'm very lucky to have met such a great bunch of guys, because had I run into some "Die Hards," I probably never would have gotten into amateur radio.

Earl Dugan, Director of the Greater Bridgeport Amateur Radio Club, really put me at ease and encouraged both of us, and still does. He always tells me that you can never ask a stupid question where radio is concerned. It's better to ask once or twenty times, rather than risk irreparable damage.

Beth, our daughter, who has some learning disability, is getting the bug through the Handi Ham Courage Center. They're another great group.

Millie Blotney KA1QOW
Keene NH

HI to Incarcerated Hams

I am trying to form a new amateur radio organization called "Hams Incarcerated" or "HI." The goals are: 1. to promote communications among incarcerated hams; 2. improve public awareness of the free public services rendered by ham radio; and 3. to establish an amateur radio station inside prison, primarily to provide public services, such as traffic handlers, net control, and emergency communications assistance.

If you are, or know, an incarcerated ham and you would like to QSO/QSL an incarcerated ham, please contact:

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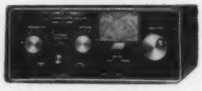

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CIRCLE 142 ON READER SERVICE CARD

73 INTERNATIONAL

edited by CCC

Notes from FN42

And who, you ask, is CCC, referred to above as the editor of this column? CCC is the new Supereditor, named to honor all of this column's correspondents who from now on will be known by us as ***Hambassadors*** *for their countries. CCC is Chauncey Charles Cuthbraith; the name is a composite of several names of historic diplomats (real and imagined) since only such a Super-Hambassador (in real life the entire editorial staff) will be able to do justice to* ***73 International*** *from now on. A list of our Hambassadors will be published here early next year—if we haven't heard from you recently be sure to let us know right away that you are still a foreign correspondent for us; if you live in a country for which we have not recently had any reports, let us know if you would like to be the Hambassador for your country.*

This month CCC brings you the first revision of **The 73 International Universal Permit Application**. *The changes from the first draft (published in January) were based on information you sent in; the next revision will appear as soon as you send us enough (1) additional useful suggestions for further changes, and most important now, (2) any* ***special information*** *that your country requires in addition. This will be coded beginning with number 51 (see the form). Please refer to numbers 1–20, as appropriate, when making new suggestions; new additions to the basic form (if any) will be coded 21 through 49. When a final form has been developed, the numbers can be dropped, and the "Special Information" listed separately, alphabetically by country.*

October's dates to spice up your QSOs: 1—National Day in China, Cyprus, and Nigeria; 2—Thanksgiving, Germany (10th for Canada); 3—National Foundation Day, South Korea; 4—Independence Day, Lesotho (12th for Equatorial Guinea, 28th for Czechoslovakia); 5—Republic Day, Portugal (9th for Kmer Republic, Cambodia; 29th for Turkey); 7—Foundation Day, E. Germany; 8—Constitution Day, USSR; 10—Columbus Day, USA (12th for Latin America); Health-Sports Day, Japan; Kruger Day, South Africa; 12—Universal Childrens Day; National Holiday, Spain (22nd for the Vatican, 26th for Austria, 28th for Greece); 14—Young Peoples Day, Zaire; 15—Evacuation Day, Tunisia; 17—Mothers Day, Malawi; 20—1944 Revolution Anniversary, Guatemala; 21—Revolution Day, Somalia; 22—Labor Day, New Zealand; 23—Chulalongkron's Day, Thailand; ***the 24th is United Nations Day****; 27—3Z's Day, Zaire; 31—Bank Holiday, Ireland.*

Roundup

Norfolk Island (Australia). A report from Kirsti VK9NL will appear next month (we hope!) and will be under the Island's own flag (standard). Norfolk is the Pine Tree Island—the *Aurokaria*, which is grown in pots all around the world. A quick note here, however, to those awaiting QSLs: remember that one IRC means *surface* mail, i.e., boat. And boats depart Norfolk Island only every other month. Be patient. (Also don't send SASEs with Australian stamps—can't be used from Norfolk Island!) More on this in her report.

Japan. The Japan Amateur Radio League, Inc. (JARL) has begun a monthly newsletter, *The JARL News*, in English, "to provide amateur operators, radio clubs, and radio regulatory organizations, throughout the world, with news [of] Japan that might be of interest," according to Shozo Hara JA1AN, JARL president. The first issue was for June, 1988. Up-to-the-minute news of the amateur satellite, F-O-12, also will be provided. No subscription information was given, so write JARL, 14–2, Sugamo 1-chome, Tishimaku, Tokyo 170, Japan. One June news item given: Station BY7HY began operating from Yueyang City in Hunan Province, **China**, in May. JARL contributed some equipment and Noboru Takada JG2GNX led a five-member delegation to the opening ceremony.

In the July issue a list of special event stations was given, only one of which will still be operating this month (the issue was received July 25th, a week before the deadline for this October column). October 23 will be the last day for 8J3SLK, operating from Nara City at the site of the Nara Silkroad Expo. Ending transmissions on September 18 on 3.5–2400 MHz (all modes) were 8J2XPO, 8J7XPO, and 8J8XPO. 8J4XPO and 8J5XPO closed down on August 31, 8J1HAM closed on August 28, and 8J0ATC, which logged 16,561 QSOs with 86 countries in 12 days in April, operated from Niigata for the 9th Asian Tabletennis Championship.

Korea. HL5AP seems still to be QRL, but Steve Bozak HL9VX ("I read your fine magazine all the time and think it's great,") writes that reciprocal amateur licenses are on the way. "All the paper work is in and the wait is on for the government to work out details. [I hope] all will be finished by the end of this year." He reports that packet radio is growing fast, with nodes and gateways on the air linking 10, 20 and 2 meters, mostly near Seoul. About ten operators are on packet. "Listen for us on 14.103 MHz. U.S. west coast has been coming in nightly." [*Thanks for the info, Steve, and we'd appreciate more news from there.—CCC*]

Mexico. The Radio Club de Nuevo Leon A.C., Arq. Javier de la Garza EX2PAG, president, is offering an International Special 25th Anniversary Award for two-way contacts, any authorized band or mode, with any three of the 45 RCNL members, who will be using the special prefix 4C2 instead of XE2 for the valid-contact period, July 24, 1988 to July 24, 1989 inclusive. For award and QSL cards, send by registered mail a list of contacts with date, GMT time, frequency, mode, RST, with QSL cards, US$5 money order, self-addressed 9" x 11-1/2" envelope and IRC, to: Gino Decanini XE2GDD, PO Box 441, Monterrey, N.L. 64000 Mexico.

Togo. Denny 5V7WD writes "From the Shack of the Togo Witch Doctor" that he and Diane (Dennis and Diane Washer) have moved from Kpalime to: Mission ABWE—Aviation, B.P.228, Kara, Togo, West Africa, with the 5-meter-long homemade wooden tower, yagi (with no rotor), TS–430, SB–200, and straight key. They are "set up on 80–10 (including WARC) and looking forward to the first 160 contact." They maintain an informal weekday roundtable with the manager, WB4LFM, on 21325± at 1245 Zulu—all are welcome. The ham population includes Steve 5V7SA and his younger brother, Ron 5V7RW, and a number of transients. "I handle the bureau cards for these hard-to-find folk." He says 40 and 80 have had good openings into

Continued on page 90

The 73 International Universal Permit Application

The following-named radio amateur respecfully requests the permission of the government of _____ to operate amateur radio equipment in the country. If permission is granted, I, the undersigned, agree to operate in accordance with ***the rules, regulations and conditions established by the permit-issuing government, by the terms and conditions of the bilateral agreement (if any) between the permit-issuing country and my country, rules of the (ITU) Geneva Radio Regulations governing radio operations, and the rules and regulations of my country. Furthermore, I certify that the following information is true and accurate.***

Full signature: _____ **Date:** _____

PERSONAL INFORMATION

1. Family Name(s) _____ **2. Given Name(s)** _____

3. Country of Residence _____ **4. Citizen?** _____ **by Birth?** _____ **Naturalized?** _____

5. Nationality _____ **6. Place/Date of Birth** _____

7. Home Address _____

8. Personal description (If not included on passport or other offical ID attached here—Color hair, eyes, weight, height): _____

9. Attach photocopies of passport pages showing name, number, and other selected data. (If passport not required for entry, attach photocopies of Birth Certificate and offical ID showing picture—such as Drivers License.)

10. Occupation (profession and place of employment) _____

AMATEUR RADIO INFORMATION

11. Callsign _____ **12. Operation license number (if any) and class** _____

13. Expiration date (If none given attach notorized certificate that license is valid) _____

14. Attach photocopy of license (If Morse speed not shown, indicate here) _____

INFORMATION ABOUT PLANNED VISIT

15. Arrival/permit to be effective date _____ **16. Departure/permit end date** _____

17. Address(es) in permit Country _____

18. Location(s) of operation(s) _____

19. Description of equipment (brands, models, XMTR, RCVR, XCVR, power amps, antenna(s), power, bands, and types of emissions

_____

20. Point and manner of entry of operator and equipment into Country _____

50. SPECIAL INFORMATION FOR THIS PERMIT-ISSUING COUNTRY (If any)

51. _____

52. _____

53. _____

54. _____

Here is the first revision of the Universal form, 10/88, based on input from PY1APS, OK3CMZ, SV1IW, 4X11MK, I2MQP, JARL, XE1MKT, ZL2VR, CT4UE, SM0COP, BV2A/2B, *and others.* ***Most*** *Countries seem to want the above information; some items have been omitted as rarely required. "Special Information" wanted will be listed elsewhere.*

The next steps: (1) Comments on this from anybody, anywhere; (2) unofficial approval (with added changes?) from you on behalf of your Country; (3) any special information required by your Country which is not listed either on this page or on the "Special Info" list elsewhere in 73 International.

The next revision will be published in about six months–please send us your contributions now–while you are thinking about it. Maybe the next revision will be good enough to send out for official national reaction!

Some "Special Information" for some countries appeared in earlier columns this year; this will be repeated with the next revision of the form, on a separate sheet (or on the back of the form). Meanwhile, remember that you can get forms specifically for Japan by sending us an SASE (SASE with 2 IRCs from outside the US—see April issue, p. 99); and the Italian Association (ARI) has offered considerable assistance to permit-seekers—see May issue, p. 93. Any other national associations willing to provide assistance to permit-seekers, let us know!

JAPANESE (JARL) BAND PLAN

50 MHz ..... 10.4 GHz

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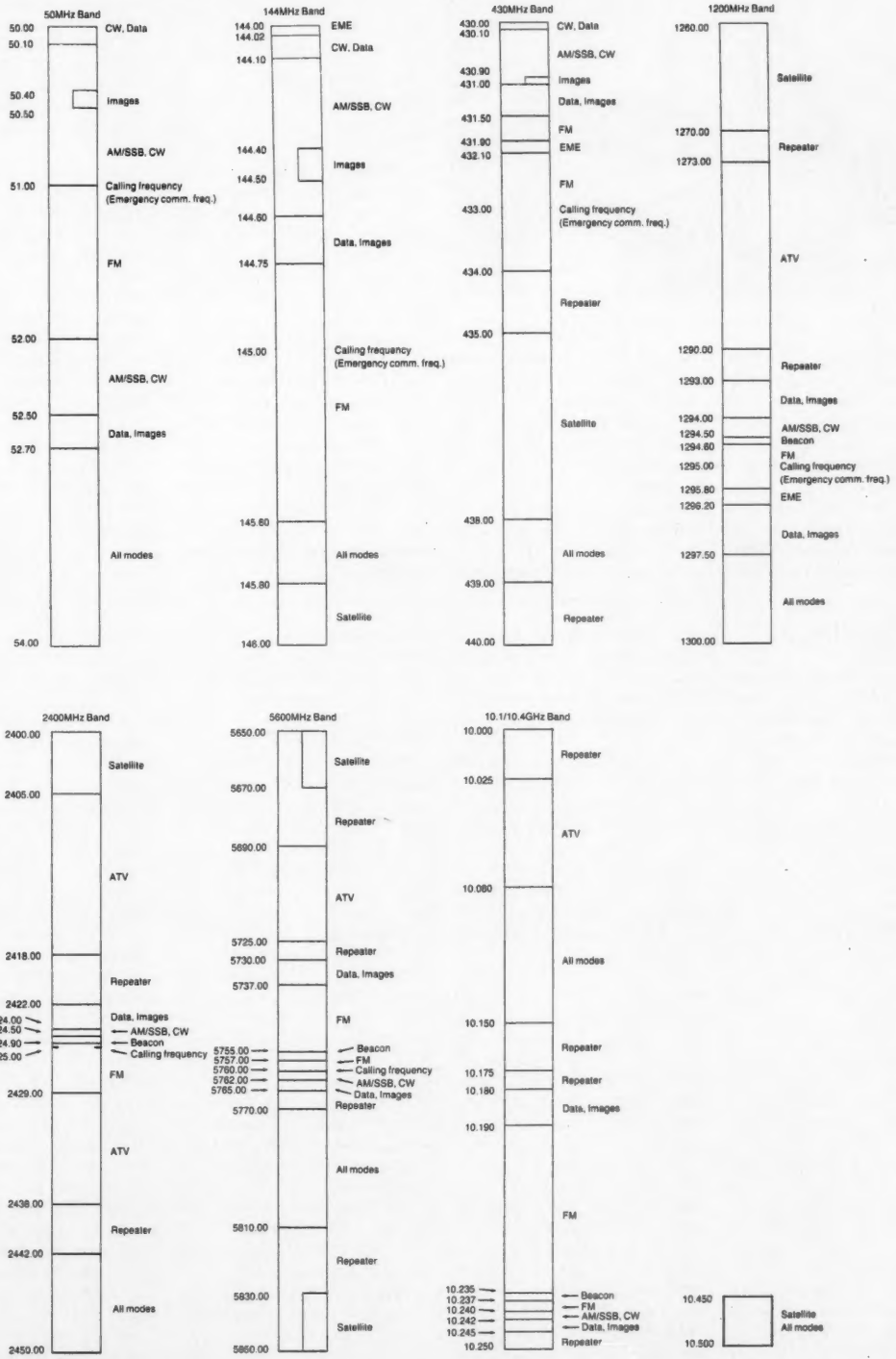
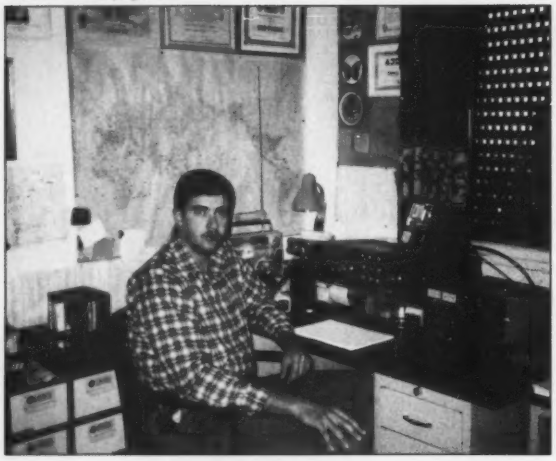


Continued from page 87



Spyros 5B4MF in his shack.

the States around 0600 local time, and the West Coast is good then on 20 meters. Wishes he could get into computer RTTY, and invites "anyone wanting to get rid of a setup [to] throw it this way!" He'll be N4EXB next.

USSR. Last month we gave UA9MA's Oblast number as 168. According to *The "DXNS" U.S.S.R. Oblast Guide* published by Geoff Watts, Editor of the *DX News Sheet*, Omsk is in Oblast 146. The 13-page guide lists and locates on outline maps all 184 oblasts comprehensively and gives contest information. (It can be obtained for 1 U.K. pound, or by airmail for US$3 or 6 IRCs—no foreign checks—the same price as for his 11-page *DXCC Countries Guide* or the 15-page *Radio Amateur Prefix-Country-Zone List*. Write him at 62 Belmore Rd., Norwich, NR7 0PU, England.)

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Although Cyprus has a large number of radio amateur licenses compared to its population (550 among 650,000), the really active amateurs on the HF bands do not exceed a dozen. One of the most active is Spyros 5B4MF, now 19 years old.

A serious DXer and contester, Spyros came first worldwide in the IARU HF championship last year, using the special call H25MF. I had a short interview with him at the CARS annual meeting, and learned that he started at age 12, in 1980, as a pupil of the English School in Nicosia. He operated from the school club station, 5B4ES, and got his own license in 1982.

5B4MF was third worldwide in the 1983 WPX contest (SSB) on 10, and was in the 10m ARRL contest as 5B4XX. He was 7th worldwide on 15m SSB in the 1984 WPX contest, second in the European DX contest in 1985, using 5B25MF, and operated as P36P in the 1986 CQDX contest and as ZC4DX in the CQDX 1987 contest (with ZC4AP, 5B4SA and 4Z4DX). This year he was H22H in the CQ WPX contest, with 5B4SA and 5B4LP.

Spyros has the DXCC, WAZ, WPX, and got the third 5BDXCC in Cyprus. His station consists of an FT102, FL2100Z, a TH3MKIII tribander, dipoles for 40 and 80 and an inverted-V dipole for 160. Mostly on SSB, he is on CW occasionally. He is now finishing his national service in the army, and this month starts his University studies in England, reading Engineering and Computer studies. He promised to answer any pending QSL cards first!

[5B4JE reports that all Cyprus beacons (5B4CY) of CARS are in very good working order (28 MHz, 50 and 70) and are much appreciated by foreign amateurs.

—CCC] 73

Never Say Die

Continued from page 6

Atlanta was hot in July. Hoo, boy it was hot. Big surprise. I wonder if this is the best time for a hamfest here? On Sunday, after the hamfest fizzled out, Sherry and I headed for the Atlanta Zoo. I understand they're working on getting Atlanta Underground going again. That used to be fun a few years ago—then teenage gangs ruined it.

Discrimination?

Are hams going to wait for some affirmative action legislation before we make an effort to attract minority groups?

How many Chinese, Indian, Black, Hispanic and so on hams have you run into on the air? How many at hamfests? I get to a zillion hamfests and I'll tell you, they are few and far between.

For that matter, even in Africa, about 99% of the hams I've met or worked have been White. This is one of the reasons amateur radio has had so little support from the African countries. They see amateur radio as a White man's hobby and the ham bands as billions of dollars of radio spectrum reserved for this tiny White elite to use purely as a playground. I don't think they realize that the Japanese outnumber the American hams about five to one, but they sure realize how few Black hams there are in the world—including all of Africa.

I realize that the long term preservation of our hams bands is not high on your list of priorities—probably right up there with stopping the genocide in Portugese Timor. But the next time you run into a Black who shows even the slightest interest in amateur radio, it's something to feel guilty about if you turn him away.

Our ham bands have been saved at the Geneva ITU conferences twice now through flukes. With one-country, one-vote, the third world can easily upset our applecart. It's only through their lack of cooperation among themselves that we have our bands right now.

Getting back to Atlanta—I want to see every able-bodied southern ham there next year. The South shall rise again—and go to Atlanta.

If you actually did go this year and have any ideas on ways to make the hamfest more fun, drop me a line. They had some fine talks—a big flea market—darned few commercial exhibitors—an amazing bunch of computers and software—must have been at least 30% of the show. I think they'll find a better location than the Omni Center next year.

The May FCC Figures

When I warned that they would be down compared to 1987, I got flack as a doom and gloomer—and wrong. Sure. Heck, wey're only down 56%—no big deal.

W5YI published the FCC figures for the last three years—too bad if you don't subscribe so you could get the bad news early. During the last twelve months the number of new amateur licenses dropped by 21%. June-May 1986/87 was 26,500. June-May 1987/88 wa s 20,893. That's a 5,067 drop. That's 21%. And those are the FCC figures.

In January we were down 47% from last year. If February we were only down 14%. In March the Novice Enhancement seemed to bring 'em out of the woodwork briefly, so we were up 243% over last year. April was down 19% from 1987 and June was a disaster, down a whopping 56%.

If you can see any signs that any approach to getting more hams is working, please advise. I don't see any indication that Novice Enhancement is making any long term changes. I don't see any sign that ham clubs are changing their pattern of ignoring the problem. I don't see any rush from the zillions of Archie comic books the League has distributed. What I see is a growth of 1.5% per year for the last three years—and the possibility that this may be completely imaginary, a figment of the FCC's not really knowing any more how many older hams have died. If 1.5% of the Silent Keys haven't been removed from the FCC's list, even that small growth may be illusory.

In the years after WWII, for seventeen years we had a growth of 11% per year. That stopped 25 years ago. If you've got a computer handy you can check it out—our growth from about 300,000 hams to 437,000 in 25 years comes out to an average growth of 1.5% per year—right where we've been for the last three years. At that rate we'll catch up to where Japan is right now in about 110 years. One thing we know positively for sure: What we've been doing toward getting new hams has been a total flop. Now we know how NOT to do it.

So let's stop with the polyanna baloney and get serious about getting amateur radio growing. 73

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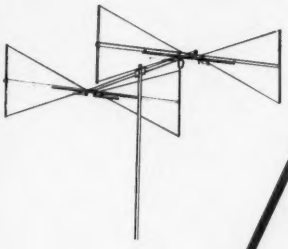

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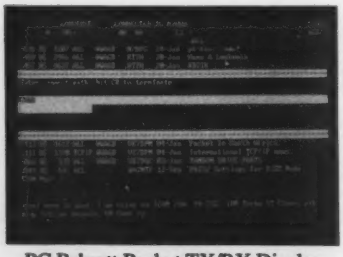

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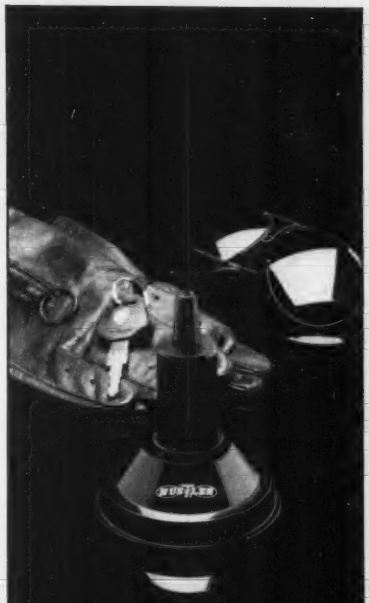

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Corrections

September Cover Credit

We give our very special belated thanks to Mr. Ken Nelson of Oakham, Massachusetts for allowing us to photograph his tower.

Digital Voice Compression—June '88

Refer to page 52. The decimal points between numbers without spaces should be fraction bars. In the first column, paragraph 3, it should read 1/7000; in paragraph 6, 1/30–1/50, 1/7000, 7000/50, and again 1/30–1/50. In the second column, paragraph 1, it should be "1/30 of a second."

Briefly Speaking RS-232—June '88

Refer to page 40. Table 1 had two columns labeled "From DCE" and "To DTE." The second column should have been "From DTE."

The Pee Wee Thirty Transceiver—September '88

Refer to page 33. The image of the circuit board, i.e. folio traces (shown in the lower left hand corner), is reversed.

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Simple Oscillator Circuit—June '88

Refer to page 74. A piece of information is missing on the circuit using the 88 MHz toroid. The output is 1 kHz. Also, the purpose of varying the BIOS is to obtain the best waveform. An oscilloscope is required.

Contest results—August '88

*Sincere apologies to **N4OKX** who was incorrectly listed as N4!KX in the results of the 1987 160 meter SSB contest. These results were published in the August 1988 issue on page 74.*

Digicom>64—August '88

Refer to page 22. IC2b, pin 4, in Figure 1 should NOT be connected to pins 6 and 7. Pin 4 is connected to the −5V supply and C12 only. Pin 6 is connected directly to pin 7.

Note also the author's new address:

Barry N. Kutner, M.D. W2UP
614-B Palmer Lane
Yardley, PA 19067

QTH DX Japan—September '88

Refer to page 89. The number of hams in Japan, the ratio of hams to Japanese residents, and the per-residents comparison with hams in the United States were stated incorrectly.

There are 1,608,128 amateur licenses in Japan, according to the Japanese Amateur Radio League. That's equivalent of one ham for every 75 Japanese residents, more than seven times the United States ratio of one ham for every 544 residents.

We reported there are 33,043 hams in Japan, the number given in the 1988 *Radio Amateur Callbook*. However, that figure includes only those Japanese hams whose calls are reported to the *Callbook*. Based on that figure, our article mistakenly stated that one out of every 3,674 Japanese residents is a ham, and incorrectly noted that ratio as about one-seventh of the ratio of the United States.

Continued from page 11

program, and called up Gerry's new digital picture. There it was, a PSTV image of an attractive young lady with the message "FROM WB8RNY" hanging just below her chin. For the second time that evening, I leaped straight up from the chair and let out a hollar.

My wife banged on the floor upstairs. "Are you all right down there?" she wanted to know. "Better than that," I shouted. "Take a look at this." In her own special way, she studied the picture on the screen. "Nice," she mumbled and headed back upstairs. Translating that from XYL jargon to ham lingo, she was as impressed as I was.

With the error-free capability of packet radio, Packet Scan Television pictures like this can be transmitted over long distances (literally worldwide when band conditions permit). The only requirements are that both users have the appropriate software to create and display the images, and that the pictures be prepared in advance.

Improvement Ideas

That last problem could be taken care of nicely with a software modification, written especially to send the digitized information directly to the packet TNC as it becomes available, or on command. This would require a second port on the computer, however (one for the digitizer and one for the TNC). The C-64 contains additional ports for the cassette drive and joystick, one of which could be used to drive the TNC.

With higher packet baud rates, such as may be used on UHF frequencies, it would also be possible to speed up the transfer so that each picture could be transmitted as soon as it is available (about one picture every 2.8 seconds with the Kinney system). This is a project for future study.

In the two years in which I have had a TNC, packet radio has provided me with many pleasures, including rag-chewing, traffic handling for the National Traffic System, computer program transfers, and now "Packet Scan Television." This latest application of packet radio may be slow and take a bit of planning, but it sure works well and results in a perfect copy of the original picture which appears at the other end.

The growth of Packet Scan Television is now in your hands. If you are intrigued by this new mode, give it a try. If you have some creative experiments in mind and are looking for a willing partner, get in touch with me via the WA8OOH PBBS in Livonia, Michigan. My mental buffer is open to your suggestions. 73

Footnotes:

[1]Kinney Software, 974 Hodsdon Road, Pownal, Maine 04069

[2]Versions of the circuit and software are available for other computers also. Consult Kinney Software for details.

[3]Print Shop, written by Broderbund Software and copywritten by Pixellite Software, is readily available at most computer stores or mail order houses.

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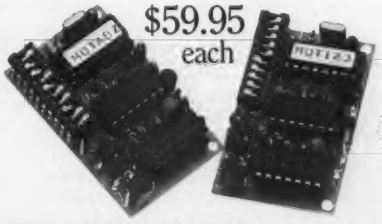

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